MARCH 21, 1960

American Machinist / Metalworking Manufacturing

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Dialed instructions single out gyros for test — see page 112

"Satellite" Shops:
Can they survive?
page 118

Special Report:
Automation in Russia
page 125

automation-

where so much depends on so little

when the tool tip contacts the work

The modern automated production line is a miracle of cost-saving efficiency. But all its ingenious complexity has but one purpose – to bring work and tooling together. *That's* the point where it either pays off or it doesn't.

To assure maximum productivity – hence maximum return on the investment – cutting tools must be sharpened with machine precision. When they are ground on a Heald Model 4 Tool Sharpening Machine, *exact tool geometry* is obtained every time – and cutting edges *last longer*, saving down-time for tool replacement.

This advanced design machine is available for both true-radius and conventional elliptical-point tool grinding. Its fully automatic tool reciprocation assures uniform and repetitive tool tip accuracy and permits one operator to tend several machines at the same time.

Ask your Heald engineer for complete information on the Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3, Issue 1.

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COVER:
Test machine for gyros developed by Raytheon receives orders from telephone dial. For details see page 112.

American Machinist | *Metalworking Manufacturing*

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TURN PAGE FOR METALWORKING REPORT →

METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Quenched Arc Cutting

A saw band that cuts with an electric arc, with the range of the arc limited by a flood of coolant, may be the answer for machining honeycomb of stainless steel, zirconium, and titanium. The process is possible on the Electro Band machines just developed by DoAll Co, Des Plaines, Ill.

Work at ground potential is fed into a rapidly moving saw band energized by a low-voltage, high-current power supply at a rate that will sustain an arc at the leading edge of the band. A flood of coolant limits the arc. DoAll reports that when all factors are properly balanced, the finish is "equivalent to that produced by grinding."

Cutting rates are said to run from 5 to 50 sq in. per min when fine finishes are required, and to range up to 200 sq in. per min when the finish of the foil edges is unimportant. At low cutting rates, flatness is said to be within ±0.003 in. tir.

Although developed for high-strength honeycomb, the process is applicable to aluminum honeycomb and may be suitable for other applications on thin work that is difficult to support, such as heat exchangers and radiator cores.

Diamond Reclamation

A 9% increase in the reclamation of fine diamond particles from machine wiping cloths, with less cost, is possible with a technique developed at Springfield Armory.

One-pound lots of diamond-bearing cloths are washed with synthetic detergent in a standard washing machine provided with a wire-mesh screen over a false bottom. Residue is fused in caustic KOH and $NaNO_3$ solution, cooled, and dissolved in water. This oxidizes carbon and tungsten. Further washing rinses out the alkali before boiling in HCl concentrate. A bit of strong HNO_3 is added to complete oxidation.

Next the residue is cooled and washed free of acid, infused with thallous formate, and subjected to steam baths. The liquid at a specific gravity of 3.5 releases its diamonds to the surface, where they float clear of other abrasives.

Complete details are available in PB 161121, available from OTS, Dept of Commerce, Washington 25, DC, for 50¢.

Tool Resetting

Tools are reset on a new Soviet lathe by a device that works much like the paper advance in connection with the carriage return on a typewriter. When the automatic gage shows that the tool is wearing, a solenoid advances a pin that actuates the toolslide advance on the next return stroke of the toolslide. Each actuation advances the tool by 0.000,08 in. A summary of developments in automation in the USSR appears in the special report starting on page 125.

FORMING

Program for a Hammer

One of the last holdouts against mechanization has been the drop hammer, but even that skill has been bottled. It is now possible to pre-select the exact number of short and long-stroke blows required to make a particular forging. After the blow pattern is set, the operator only has to start the cycle.

The program-control device is a "Ceco Blowmatic," designed for the Ceco-Drop air-lift, gravity-drop hammer built by Chambersburg Engineering Co, Chambersburg, Pa. It produces a uniform cycle, forging after forging, with hammer stop at the end of each cycle and the ram clamped in raised position ready for a new forging.

Quality of forging work and production rate are both improved by the device. A standard forging method can be set up for each job. The operator has an easier time because he does not have to treadle the hammer to change stroke length.

The Blowmatic has a clamp-cylinder valve, electrically operated pilot valves that control the clamp and short-stroke mechanism, and an electric program control in a separate panel.

Forge Stepped Shafts

Long parts with as many as seven stepped diameters can be hot forged by a vertical swaging machine marketed under the name De Roll. Straight sections are sized for diameter and length by a preset control drum that operates the hydraulic system. A templet controls the tools on shallow tapers.

A chuck that slides in vertical ways grips the billet, which is rotated and fed down into a "forging box." Three swaging hammers in the box are driven by an eccentric. Diameters are controlled by stops, and the forging speed is controlled by adjustable throttle valves. Maximum reduction of diameter in one step is ½ in. Time per step is 1-3 seconds.

An important feature of the equipment is quick setup for short production runs. Accuracy is guaranteed to be within ±0.008 in. for diameters of 1⅝ to 2½ in.

Maximum part length is about 44 in., and maximum pressure on the work is 100 tons. Power is from a 30-hp motor. Machine builder is Gesellshaft de Ludw von Roll 'schen Eisenwerke AG, Bern, Switzerland.

Castings for Prototypes

"Foam vaporization" is a casting process, much like the lost-wax method, that you may want to try for prototype parts. The technique gives the modelmaker or sculptor greater freedom in creating a pattern, and the model can be faithfully reproduced in a casting.

Development is being carried on

by Alfred M Duca, research associate in the Department of Metallurgy at MIT, and himself a professional artist. The process results from a search for a way to revive sculpture casting in this country. In recent years, most sculptured pieces have been sent to Europe for casting.

Working under a grant from Rockefeller Foundation, Mr Duca looked for a material with structural properties that would give an artist complete freedom in manipulation, and at the same time could be made to "disappear" from a sand mold at pouring. He found the material in lightweight porous polystyrene plastic.

After being carved to shape, the sculpture or pattern is sand molded. Sodium silicate is mixed with the sand as a hardener, and carbon dioxide is pumped through the mold to react with the chemical. When the metal is poured, the plastic vaporizes as the finished casting is produced.

INSPECTION

Photocell Alignment Tool

A "position-sensitive" photocell is the heart of a new inspection device for machine beds, shown recently in London by British Scientific Research Association. One end of the machine bed is fitted with an optical cone (presumably to reflect light), and a trolley is mounted on the other end of the bed, and moved toward the cone. The trolley carries an illuminated pinhole and the photocell, plus two servo-controlled parallel plate micrometers. As the trolley moves, the micrometers continuously adjust to keep centering the light on the photocell. These adjustments are converted to electronic signals by a second photocell device to produce a continuous record—as on graph paper—of bed straightness.

HEAT TREATING

High-Temperature Refractory

One of the limiting factors in heat treating is the heat resistance of the furnace components. This is becoming more and more of a problem as the new high-temperature alloys are introduced. Of late, several new insulating ceramics have been developed, latest of which is Ipsen's high-temperature ceramic insulating brick.

Developed by Ipsen's Ceramic Division, Pecatonica, Ill, this material was described briefly, in Metalworking Report in the Nov 30, 1959 issue. Now full details have been announced. It has the density of a 1600-F insulating firebrick, an insulating value comparable to a 2300-F firebrick, is good to 3400 F.

This cellular ceramic material is being used as lining for hydrogen and vacuum furnaces, and in other high-temperature metallurgical operations. It can be readily cut, sawed, or filed to shape, has a porosity of 88%, and is 97.1% alumina.

THE OUTLOOK

Capital spending by industry in 1960 will show a 14% increase over 1959. Total outlay will be about $37 billion, up from $32.5 billion last year. All segments of metalworking will share in the climb, with the electrical-machinery industry setting an all-time high in expenditures. For a full breakdown of these new plant and equipment expenditures *see page 124.*

WELDING

Friction-Welding Machines

A new machine has been announced by the Russians for their friction-welding technique. This is the process in which a stationary part and a rapidly rotating part (about 3000 rpm) are held together under high pressure (1120 to 9200 psi, depending on the material). The resultant friction generates enough heat to fuse the parts.

The technique has been employed for joining rods and cylindrical parts. Presumably, it can weld a rod to almost any other shape.

When the parts reach welding temperature, the rotation is stopped and the pressure is maintained, or increased, for a brief interval. Total time is 10 to 25 sec.

Almost any machine tool can be modified to perform this kind of welding, but the Soviets have found that ordinary machines suffer considerable wear. Now, new machines have been designed specifically for the process and will soon be coming off the production line, according to the Soviet monthly, *Morskoi Flot*.

ASSEMBLY

Plating Joins Waveguides

Electro-deposition is a method of assembly at Allied Research & Engineering, Los Angeles. It works on waveguides, where tubes are fitted to flanges (press fit), and electro-deposition covers the joint for extreme smoothness.

This replaces silver soldering, which caused distortion because Invar (zero coefficient of expansion) is the tube material. Deposit is nickel or copper.

Electro-deposition is a cold process (room temperature), and has no distorting effects. Depth of deposit is easily controlled to produce any strength required, and tubes and flanges can be masked to leave a deposit only at the joint line.

Screw Torque

The only way to find out just how much torque a given bolt of a given material will take is to make a comprehensive test, torquing sample bolts to destruction. This is just what John A Stevenson of the H M Harper Co has done with standard bolts in seven different basic metals.

The trouble with formulas is that bolts in various metals are not just proportionate in torque capacity according to size and ultimate tensile strength; fatigue, work hardening, and manufacturing differences make final results vary all over the lot. Take lubrication, for example; a sample aluminum bolt with wax lubricant broke at 65 in.-lb, while an identical sample dry broke at 100 in.-lb. Therefore, the table of permissible torque loads (p147) is based on actual tests of standard bolts made with torque-wrench equipment.

FINISHING

Gold Bricks

Genuine 23-karat gold coatings (AM—Dec 28 '59, p 61) can now be applied to porcelain-enameled steel panels, stainless steel, ceramic tile, glazed brick, structural glass, and other materials. Developed by the Hanovia Gold Div, Engelhard Industries Inc, New York City, an organic gold solution is applied to the work surface by brushing, dipping, rolling, or spraying, and is then fired. Smoothness of the original surface determines the final finish of the pure gold layer, which may be varied from matte to brilliant. Decorative patterns may be produced by silk screening, rubber stamping, roll-

er stippling, or by rolling on a textured surface to hit just the high spots.

The gold film is permanently bonded to the metal and is unaffected by sunlight, weathering, or strong cleaners. Principal applications to date have been in the architectural field, but the process may well be adopted for eye appeal in the domestic appliance field.

MATERIALS & COMPONENTS

See While You're Grinding

In the "why-didn't-we-think-of-that-before?" category, a special fiber-backed abrasive disk has straight sides that cut segments from a full circle. This gives the finisher or grinder a partial view of the work being ground as he works. The Behr-Manning (Troy, N Y) development leaves about an inch-wide vision belt that stops work interruptions to check the part an dreduced dwell time, because grinding can be confined to exactly the area that needs it.

Magnetic Switch

Permanent magnets operate a new kind of switch that has only one internal moving part and no springs. Developed by Reed Research and to be produced by Space Components, Inc, Washington D C, under the name Fluxlink, it depends on "piped" magnetism.

A magnetic field can be extended beyond the magnet by adding a permeable material to the field. This idea is applied to the high-temperature, hermetically sealed switch. The round switch body is closed at one end by an insulating sealed header such as ceramic, through which pass three circuit wires. The header at the other end is non-permeable stainless steel with four small magnetically-permeable-stainless plugs, which allow the field to go through the header. A magnet on the outside of the switch, operated mechanically, flips a V-shaped magnet (which carries contacts) inside the body.

It should soon be available in three grades, one a molded-plastic body for normal service, one in stainless for high-temperature, high shock conditions, and a super grade for up to 900 F and 1000-g loads.

MANUFACTURING CONTROL

Time Formulas From a Book

Job shops can now pull the major part of time formulas from a book: *The Standard Data Manual for a Machine Shop.*

An extension of the H B Maynard Co's pioneering work in methods-time measurement, the manual in effect collects M-T-M data for a job shop under one cover. It breaks any operation down into the basic motion required to perform it, assigns standard units of time to complete each basic motion, then totals these units of time to give the time standard for the operation.

Before Maynard experts developed the manual for use in their consultant work, the M-T-M man had to develop and total scores of basic-motion times to get the standard for an operation. The new manual can give him this standard in a matter of minutes. For a detailed description of the manual, see p 138.

Spotlight on Equipment

Westinghouse has a "Physical Review of Manufacturing Facilities" now going on that has shown that 27% of the company's equipment could be declared surplus, book value should be reduced 13%, and monthly maintenance costs could be reduced about 12%. This is an actual physical review, not just paperwork, that concentrates on 100 pieces of equipment or so in a department.

Under the direction of Headquarters Manufacturing Planning, analysts take a random sample of equipment and start probing. A typical study team of manufacturing manager's representative, manager of manufacturing engineering, foreman, industrial engineer, product engineer, purchasing rep, and production rep ask questions.

Can the operation be combined on other equipment to release this machine? Will a design change eliminate this operation and free the machine? Will a change in layout or tooling improve the operation? How many hours per day does the machine work to meet standard volume? Can the equipment be declared surplus?

A total of 30 surveys has been made so far to provide a much clearer picture of the state of the physical equipment than formerly possible.

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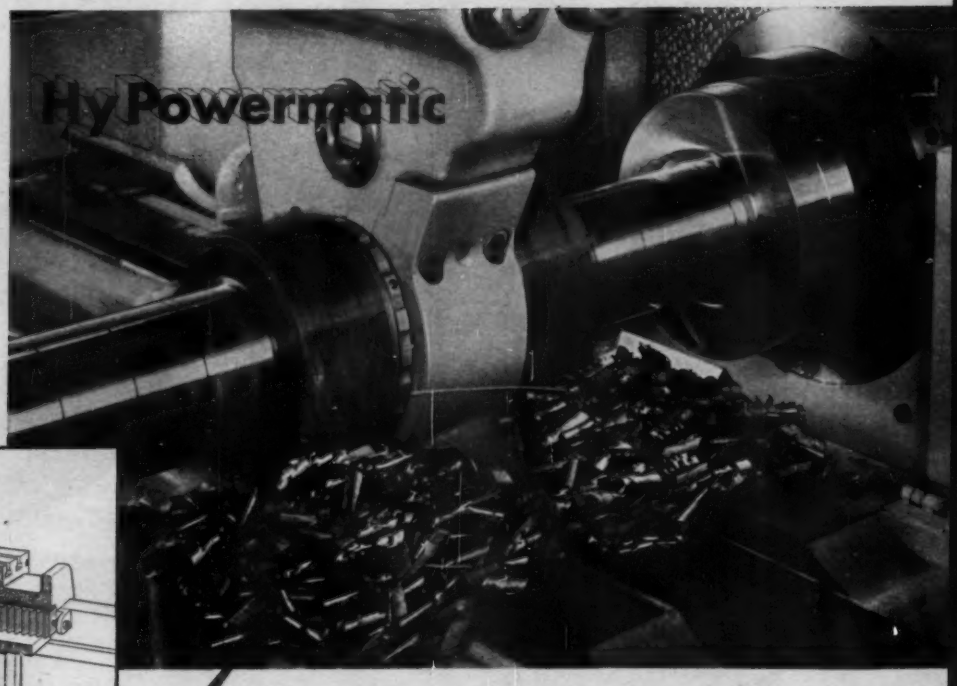
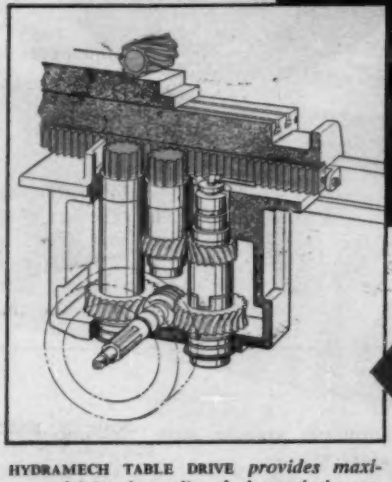
Always a smooth powerful cut

on the **HyPowermatic**





HYDRAMECH TABLE DRIVE *provides maximum driving force directly beneath the cutter regardless of table travel or bed length . . . consists of hydraulic motor, driving twin vertical pinions that engage table rack.*

. . . with exclusive

HYDRAMECH TABLE DRIVE

For high production milling of medium-to-heavy parts, CINCINNATI HyPowermatics offer you a number of cost-saving features. One of these is Hydramech, Cincinnati's exclusive table drive unit which applies force exactly where it belongs—*direct to the table, immediately below the cutter*—not through long leadscrews driving the table brackets. The result is uniformly smooth cutting action on *every* HyPowermatic regardless of size.

Table feeds are infinitely variable up to 150" per minute and can be changed even during milling, by a simple twist of a dial. Hydramech Drive also incorporates Cincinnati's backlash eliminator, which permits both conventional and climb milling.

CINCINNATI HyPowermatics are making unusual production records in shops everywhere, through Hydramech and many other outstanding advantages. You'll find more details on the two pages following, and complete information in Catalogs M-1909-3 and M-2028-2. May we send you copies? **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI®
MILLING MACHINE DIVISION

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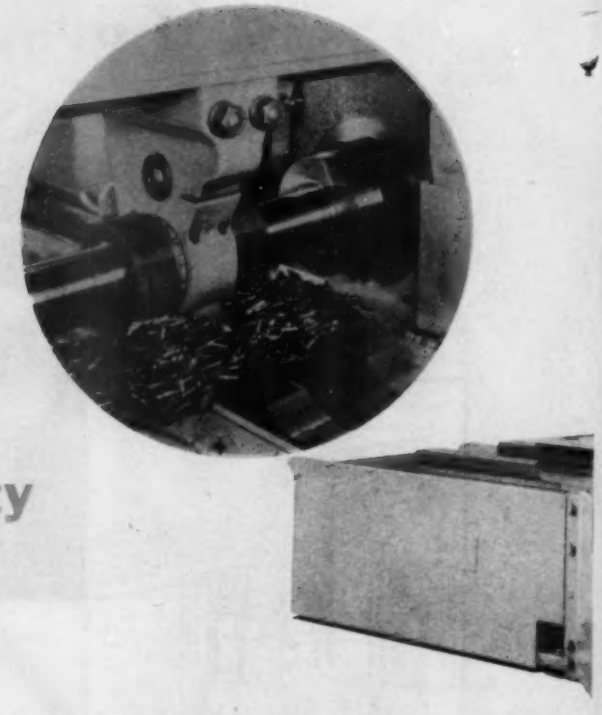
make quick work of your **heavy duty milling** *operations*



You'll see costs take a big tumble when you assign heavy duty milling jobs to the big CINCINNATI HyPowermatics. These machines have the capacity to remove metal quickly—both hard-to-cut alloys and lighter metals. And they embody a number of convenient features that enable the operator to turn out more work with no increase in effort. Some of the HyPowermatic design highlights are:

- infinitely variable table feed rates, ¼" to 150" per minute
- a wide range of 16 spindle speeds
- only three gear contacts in spindle drive
- Hydramech table drive, assuring uniformly smooth cutting action
- built-in backlash eliminator, for conventional and climb milling operations
- automatic spindle stop, an important safety feature
- automatic, two-way table cycles
- J.I.C. hydraulic and electrical standards
- Dynapoise vibration damping overarm
- choice of plain, duplex, tracer controlled plain and duplex, rise and fall plain and duplex; 50 sizes in each

In addition to these many standard design features, Cincinnati's unit type construction plan can help you obtain special machine capabilities with low cost investment. Complementary units include close-coupled spindle carriers, vertical and angular spindle heads, and others. Get the complete HyPowermatic story by writing for Catalogs M-1909-3 and M-2028-2.

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THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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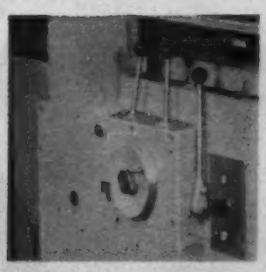
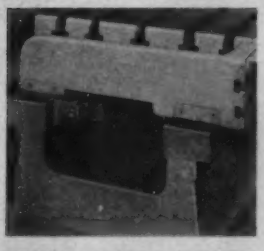
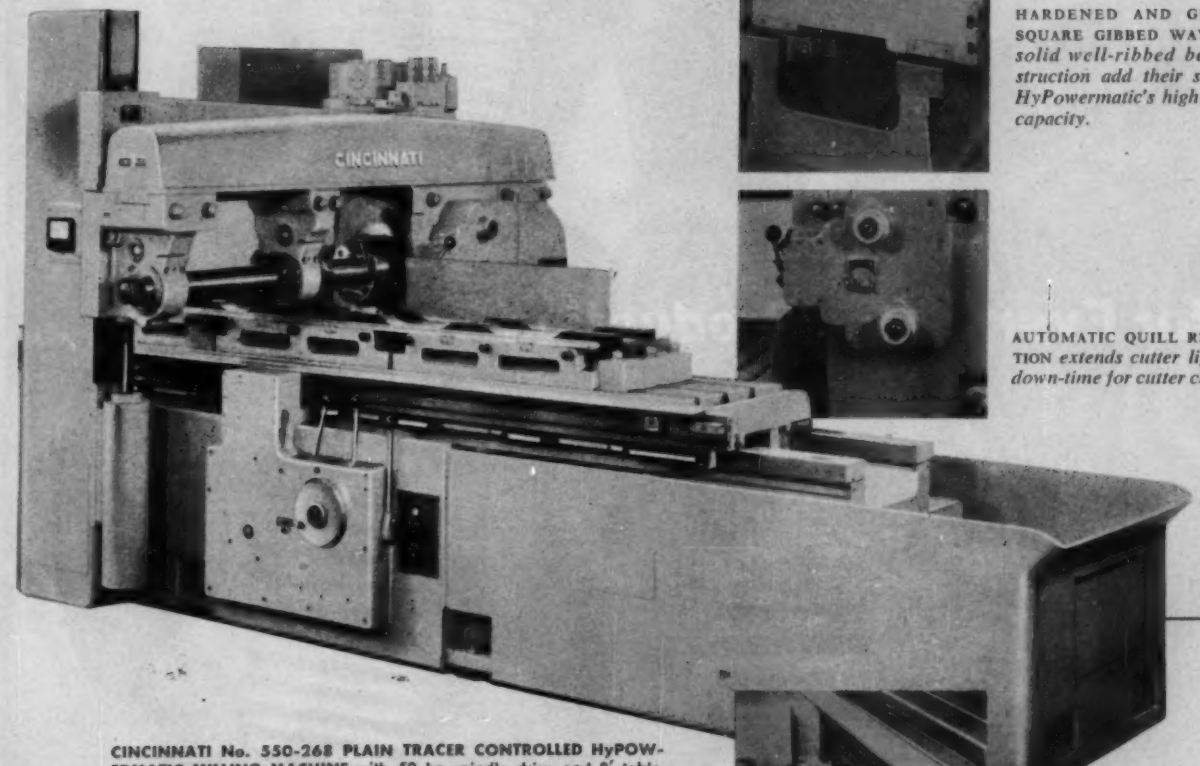


CONVENIENT OPERATING CONTROLS, *all compactly grouped, reduce operator fatigue and increase production.*

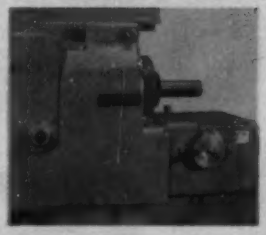


HARDENED AND GROUND SQUARE GIBBED WAYS *and solid well-ribbed bed construction add their share to HyPowermatic's high cutting capacity.*

AUTOMATIC QUILL RETRACTION *extends cutter life, cuts down-time for cutter changes.*



AUTOMATIC VARIABLE FEED *automatically controls the feed rate during the cut . . . a definite aid to economical production.*



QUICK CHANGE SPINDLE CARRIERS *are a valuable time-saver when frequent speed changes are necessary because of either short runs or changes in tooling.*

CINCINNATI No. 550-268 PLAIN TRACER CONTROLLED HyPOWERMATIC MILLING MACHINE with 50 hp spindle drive and 8' table travel, milling spring bars for generator motors. The complete HyPowermatic line includes:

No. of Sizes	Types	Table Traverse	Feed hp	Spindle hp
50	Plain	2'—14'	3—5	5—50
50	Duplex	2'—14'	3—5	5—50
50	Plain Rise and Fall	2'—14'	3—5	5—50
50	Duplex Rise and Fall	2'—14'	3—5	5—50
50	Plain Tracer Controlled	2'—14'	3—5	5—50
50	Duplex Tracer Controlled	2'—14'	3—5	5—50

Write for Catalogs: M-1909-3 for 300, 400 and 500 Series HyPowermatics; M-2028-2 for 100 and 200 Series HyPowermatics.

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CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

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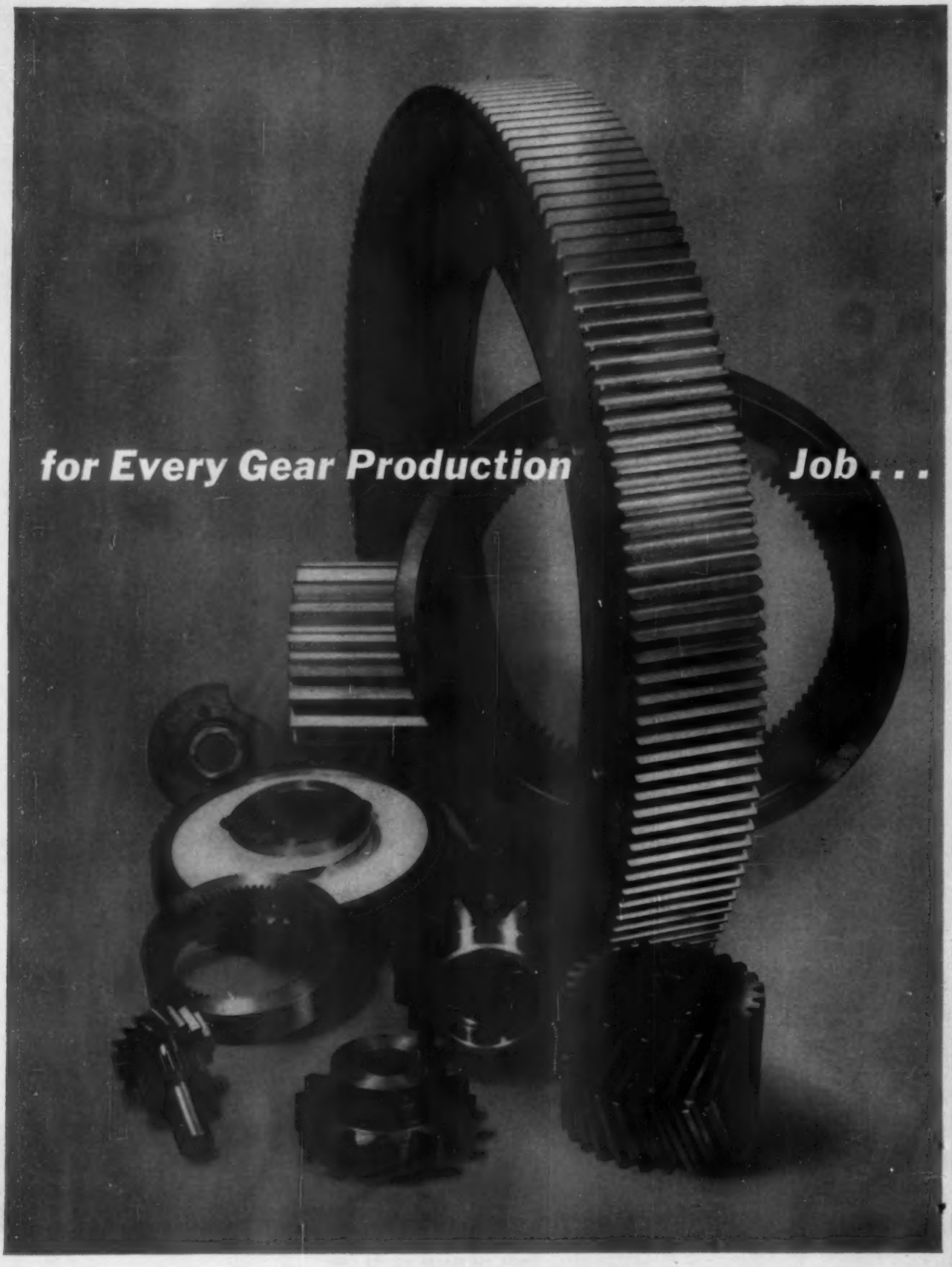
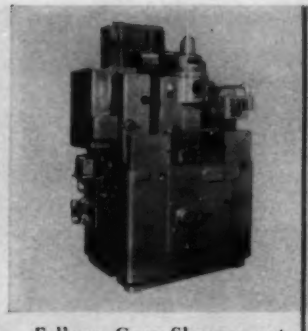

for Every Gear Production Job . . .

Right from the blank to the finished external or internal spur or helical gear, Fellows has the complete line of gear production and inspection equipment to meet all your requirements!

No other builder in the world offers as long and varied a line: Fellows Gear Shapers; Pfauter Gear Hobbers; Fellows-Reishauer Gear Grinding Machines; Fellows Gear Inspection Instruments; Fellows special machines and attachments; Fellows Gear Shaper Cutters. All this, *plus* the benefit of our sixty years of specialized experience in solving gear production problems.

Ask your Fellows representative for information on the complete line of Fellows gear production and inspection equipment. If you have a problem requiring special equipment, ask him to help you solve it, or write direct.

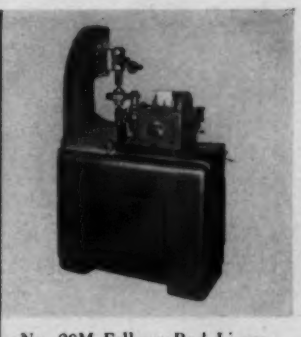
. . . . Fellows Has the Equipment to Shape, Hob, Grind and Inspect



Fellows Gear Shapers cut internal and external spurs and helicals; capacities to 120" P.D.

Pfauter Gear Hobbing Machines for spur and helical gears; capacities to 120" P.D.

No. 12 Fellows-Reishauer Gear Grinding Machines grind spurs and helicals to 12" O.D.



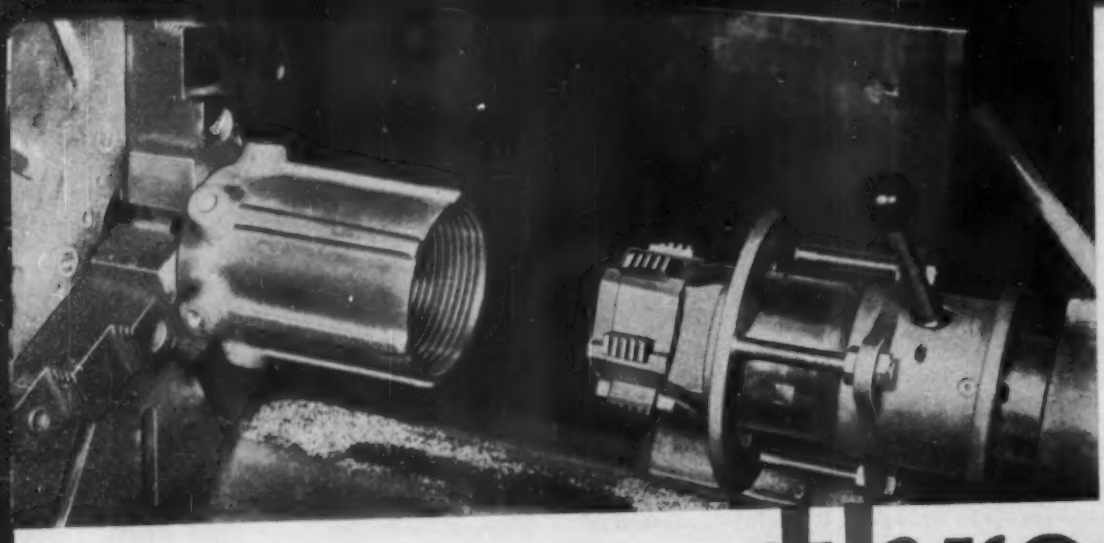
No. 20M Fellows Red Liners make and record the "composite check" of spur and helical gears to 18" P.D.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont

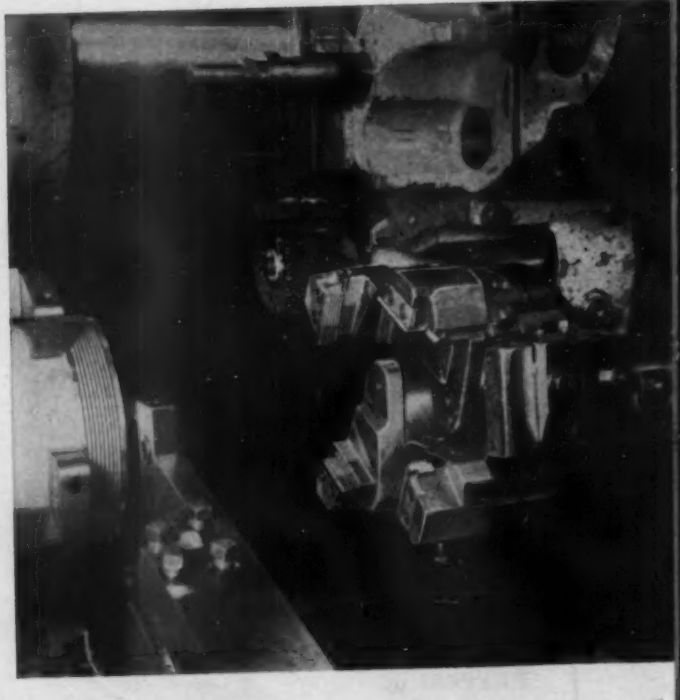
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

Fellows *Gear Production Equipment*



the world's largest selection of **thread**



CIRCLE 159 READER SERVICE CARD

[redacted] ...

requires the selection of the proper Thread Cutting Tool for the job to be done, and is the essence of LANDIS design. To ensure that you may use the most efficient threading tool, LANDIS manufactures the world's largest selection of Thread Cutting Tools ... both internal and external.

cutting tools

[redacted] ... in a range of 1/8"—9¼" for threading machines, turret lathes, screw machines, reversing spindle machines, bar automatics. *Heat-Treated* types for economy, wide range coverage, quick set-up changes and oversize capacity. *Hardened and Ground* types for work on which extreme accuracy and maximum production are of prime importance. *Solid Adjustable* types for high production threading on reversing spindle machines.

[redacted] ... in a range of 1¼"—24". *Collapsible Taps* for producing parallel threads, *Receding Chaser Collapsible Taps* for tapered threads. Both have wide diametrical range through use of detachable heads. *Non-Collapsing Solid Adjustable* types for high production tapping on reversible spindle machines. Special Taps are available.

[redacted] ... all Landis Die Heads use Landis Tangential Chasers featuring: interchangeability, natural cutting clearance, permanent throat, useable for most of their length, right- and left-hand threads with the same chasers, and changeable rake and lead angles. Landis Tap Chasers, manufactured with the same consistency of quality and experience as the Tangential Chaser, are "tailor-made" to suit the application to produce a high degree of thread finish and the maximum number of pieces between grinds.

The constant research for better threading methods which has brought to LANDIS leadership in its field today plays an even more important part in our activities. We offer all manufacturers our over 50 years experience in all phases of Threading. If you need help involving threads, whether design or production, or if you feel that your present threading methods should be improved, send us your specifications, or our representative will call at your convenience on request.

LANDIS *Machine* COMPANY WAYNESBORO PENNSYLVANIA

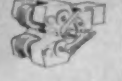
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines

Die Heads – Rotary & Stationary

Taps – Collapsible & Solid Adjustable

Centerless Thread Grinding Machines


Thread Rolling Tools

Thread Rolling Machines

LANDIS micro

feed

for grinding to your closest tolerances...automatically

MICROFEED, a new precision wheel feed, is the biggest news in cylindrical grinding today. MICROFEED, on a new Landis grinder, assures precision to extremely close tolerances on a production basis.

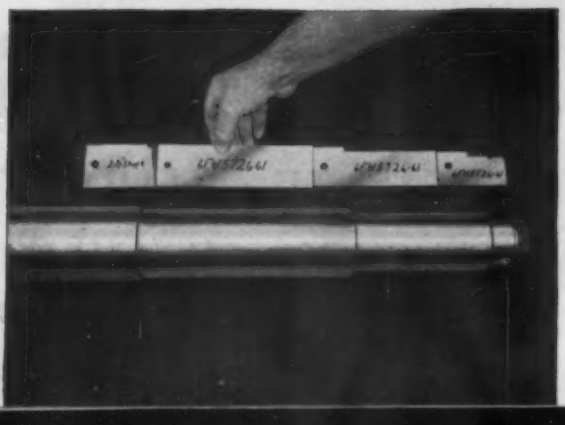
This radically new wheel feed automatically cancels all variables which affect precision grinder feed systems. On piece after piece MICROFEED repeats its action with unerring accuracy.

MMT-PE

LANDIS

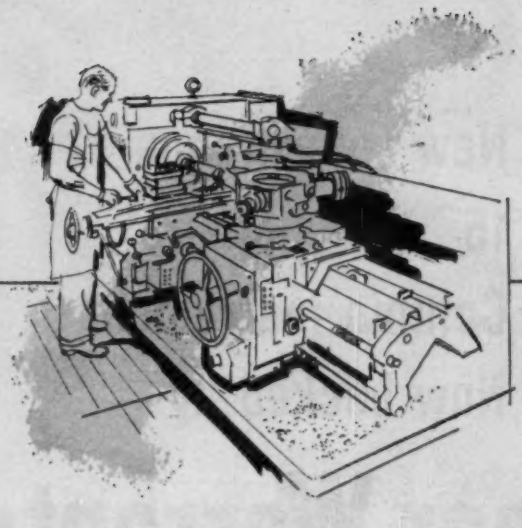
precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



Unique Section Template was one idea which Hobart tooling specialists came up with to reduce setup time and minimize template costs. A short template was made up to handle a range of shafts with similar ends. Various length middle sections could then be quickly inserted to obtain various lengths and shoulder locations. A three-section template is shown in use on the machine in upper photo. The interchangeability feature of the template sections is shown at left. Two pieces of this four-section template – the section marked "2⅛ Shaft" and the spacer section held in hand – are also used in the above setup.

CIRCLE 163 READER SERVICE CARD



AT HOBART BROTHERS COMPANY
TROY, OHIO

Warner & Swasey 2-A with contouring cross slide

- *Slashes setup time*
- *Combines auxiliary operations into one setup*
- *Produces shafts at 1948 cost levels*

HOBART BROTHERS CO.—a leading producer of arc welding equipment and aircraft ground-power units—faced a serious production bottleneck. Long setup time on their older turret lathes and excessive part handling time was crippling the small lot production of motor-generator shafts. Because their production scheduling for 77 different models of arc welders, 20 models of ground-power units, plus numerous specials, is tied directly to sales, lot sizes frequently had to remain small—usually from 1 to 20 pieces.

Hobart launched a three-pronged attack to solve the problem by:

1. Installation of a new Warner & Swasey 2-A Saddle Type Turret Lathe equipped with a hydraulically-controlled cross slide contour unit.
2. A creative tooling approach to reduce setup time.
3. A thorough time and motion study to insure efficient utilization of daily production time.

As a result, Hobart Brothers today are producing shafts at 1948 production costs!

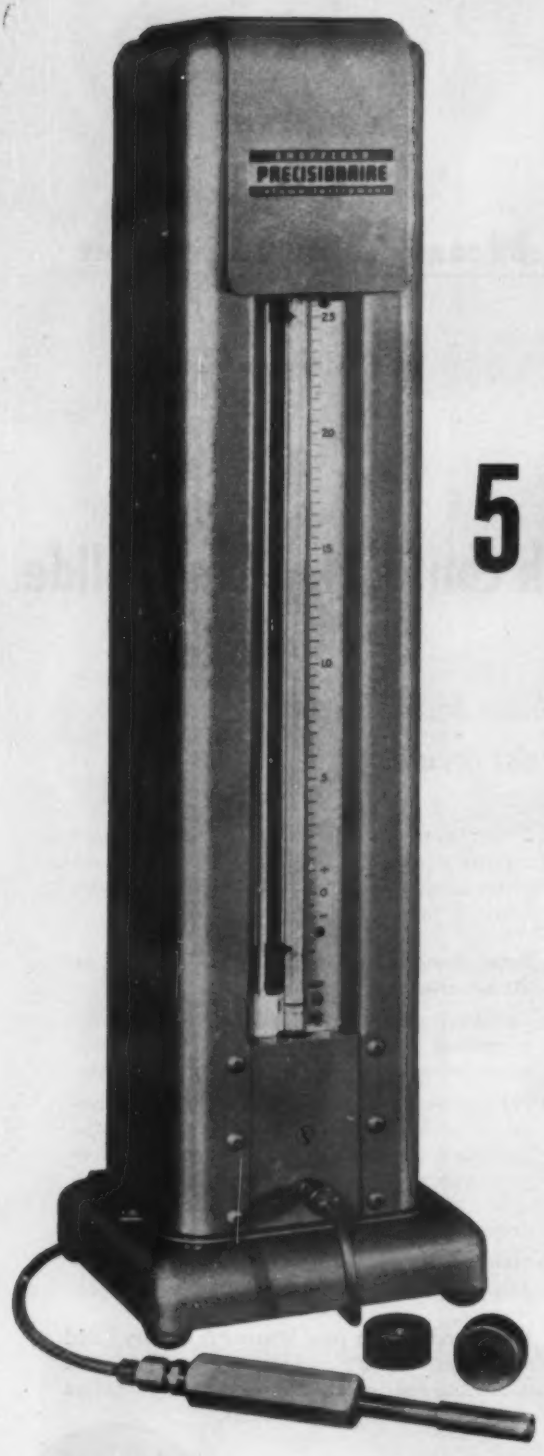
Contributing to the success of this efficiency study and modernization program was their new contour cross slide equipped Warner & Swasey 2-A which permitted:

- **Setup time to be slashed—from 2 hours to 20 minutes.**
- **Combining of center drilling, facing and threading operations into a single, efficient turret lathe setup reducing part handling time.**
- **Production time savings averaging 35% because of higher horsepower and spindle speeds, and elimination of extra hex turret and square turret handling time. All diameters and grinding reliefs are produced directly from the template.**
- **Holding closer tolerances which reduced grinding time and extended grinding wheel life.**

Check today with your Warner & Swasey Field Representative. He'll gladly tell you how the cost-cutting results of the "Hobart Story" can be a reality on your own operations.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY



New Long-Range 15″ Precisionaire® Column Instrument Now backed by

5 Year Warranty

For all cost-conscious gage buyers, Sheffield's new 5-year Quality and Reliability Warranty on Precisionaire Column Instruments shipped with Sheffield gaging tooling is important news. In addition, 15″ Precisionaire Column Instruments are now supplied in multi-column models, with 5000 to 1 and 10,000 to 1 amplifications. (Higher amplifications up to 100,000 to 1 obtained with Super-Amp Package.)

This instrument doubles gaging range, cuts initial gage cost, reduces gage inventory and upkeep.

You can inspect wider part tolerances at higher amplification with greater accuracy and speed.

You can classify parts into more size increments with a wider scale spread for each class—fewer borderline cases.

You can better control in-process gaging because of greater approach or "come-up" range.

Amplification of Plunjet® gaging cartridges is doubled and full amplification is obtained when gaging small diameters.

Call your local Sheffield representative for a demonstration or write Dept. 1.

The **SHEFFIELD** *Corporation* *Dayton 1, Ohio*

A subsidiary of the Bendix Aviation Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

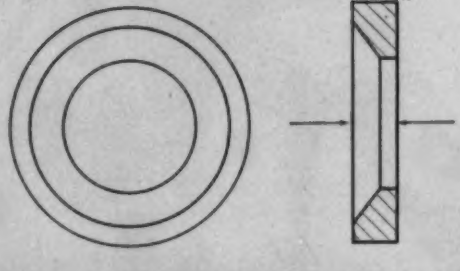
Disc life up 71% with new Gardner GR structure control

...new Gardner abrasives grind 43,567 *more* valve inserts than former discs

production facts

Part	Valve inserts
Material	Carbon steel
Hardness	35 to 60 Rockwell
Machine	Double Disc Grinder
Disc size	26" x 2" x 10"
Production life	Former discs—61,000 parts New Gardner discs—104,567 parts

MMT=PE

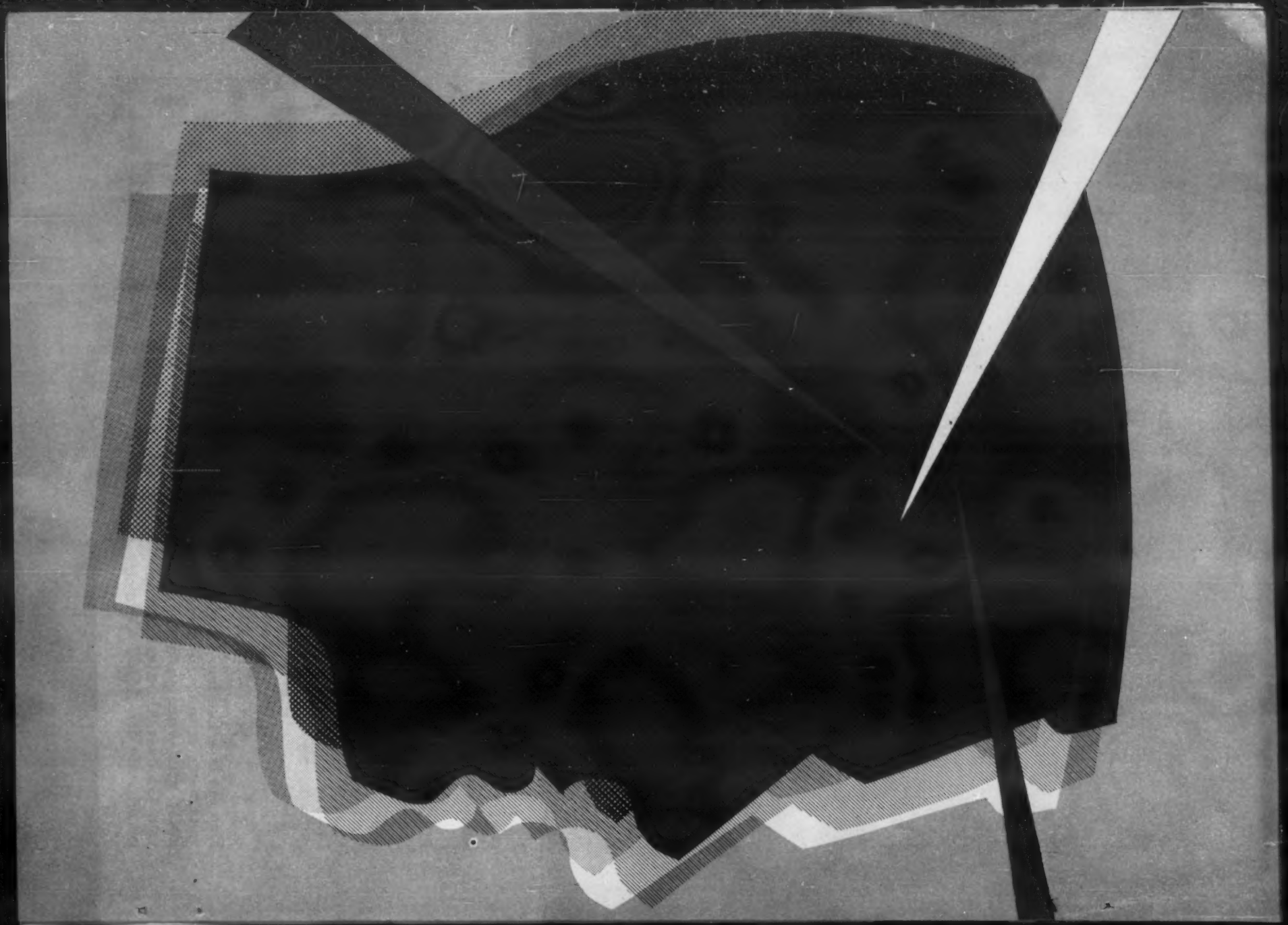


Find out how Gardner's latest developments in abrasive discs can lower your grinding costs! Call your Gardner Abrasives Specialist or write for AC-57 Catalog.

GARDNER

abrasive discs

BELOIT, WISCONSIN



Are you shock-proof?

Ever sit in a traffic-trapped taxi for an hour . . . only to find your destination was just around the corner? Ever build a patio . . . only to find a contractor would have done it for less than the cost of your materials? Ever sweat six months over a problem on the job . . . only to find the solution had been available by picking up the phone?

Carpenter can't shock-proof you from everything, but we *can* help you with the application of electronic, magnetic and electrical alloys. No matter how difficult your problem, there's an excellent chance that our continuing research and development program has already produced information to save you time and money.

In addition to leading the field in technical assistance to industry, *Carpenter* also provides the convenience and reliability of one-source supply. You name it—dimensional control, resistance control, magnetic control—*Carpenter* offers the world's widest range of alloys to meet your most critical needs.

Carpenter alloys provide easy, fast fabrication, such as blanking, edge-winding, spot-welding and machining. And you waste no time experimenting to find the proper heat treating methods and temperatures. Highly specialized as these alloys are, *Carpenter* has "standardized" their properties to minimize problems from design to delivery.

Why not check *Carpenter now* . . . instead of later?

Carpenter **steel**

tool and die steels
stainless steels
electronic, magnetic and electrical alloys
high temperature alloys
special-purpose steels
tubing and pipe
fine wire specialties

a new company 70 years old

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.

Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

CIRCLE 168 READER SERVICE CARD ▲

CIRCLE 169 READER SERVICE CARD ►

GRAY + NORDEN

Extensive product research showed Norden system of numerical control superior to any contemporary system for Gray horizontal boring machines and milling planers. Jointly developed by Gray and Norden expressly for machine tool application, the Gray space setter's unique features make it the most sought after control of its kind.

Compare these salient features:

- Read-out. A visual display clearly indicating at all times the exact location of a machine tool element.
- Zero Off-set. Ability to establish zero read-out on the display at any predetermined reference point on the work piece. Operator then reads drawing dimensions on display unit.
- Work to closer accuracies. Overall accuracies within .001". Unaffected by line voltage.
- Greatest productivity over prolonged period. Replaceable modular construction facilitates quick servicing.
- Progressive steps to full tape control. Each phase may be purchased individually.

The G. A. GRAY Co. Cincinnati, Ohio

Builders of—Planers • Milling Planers • Planer type Milling Machines • Horizontal Boring Machines

= space setter

"Even our standard stock wheel

Elden L. Auker, Vice President—Marketing of Bay State Abrasives, is a man who knows the industry through years of experience both in working in the field with Bay State customers and from close association with the research and development programs at Bay State's manufacturing headquarters in Westboro, Mass.

"There's only one thing in this business that gives me a bigger kick than seeing a new Bay State wheel specification turn out successfully. That's when one of our standard wheels goes into a series of tough tests and proves it has what it takes to beat the competition.

"That's what happened recently at Omaha Steel Works. They're one of the largest and most diversified processors of structural steel, weldments and steel castings in the entire Western area of the U.S. . . . and, believe me, they are test-minded.

"As our own Abrasive Specialist, Gene Miller, says: 'This was one time when sales talk was strictly *verboten*. They wanted the best wheel they could get for finish-grinding steel castings and they asked all the major abrasives manufacturers for wheels to test. And, did they give them a going over! There wasn't anything they didn't check. The results showed our stock specifiication beat out all wheels in cutting speed and length of life so it cut their cost-per-hour figures and naturally reduced down-time for wheel changes, too.'

"Well, there's one example. But there are plenty of others. And they all prove the importance of *testing* . . . even testing wheels that are doing a perfectly acceptable job . . . because we may well have a standard stock wheel that could do a whole lot *better* job. In your tool room, for example, or on the production line, put your Bay State distributor or our direct representative on the trail and you could quite possibly wind up with substantially improved performance and cost figures just by switching to a standard Bay State wheel, straight out of inventory. Our people will cooperate in any tests you want to set up because . . . *better grinding at lower cost . . . that is their business.*

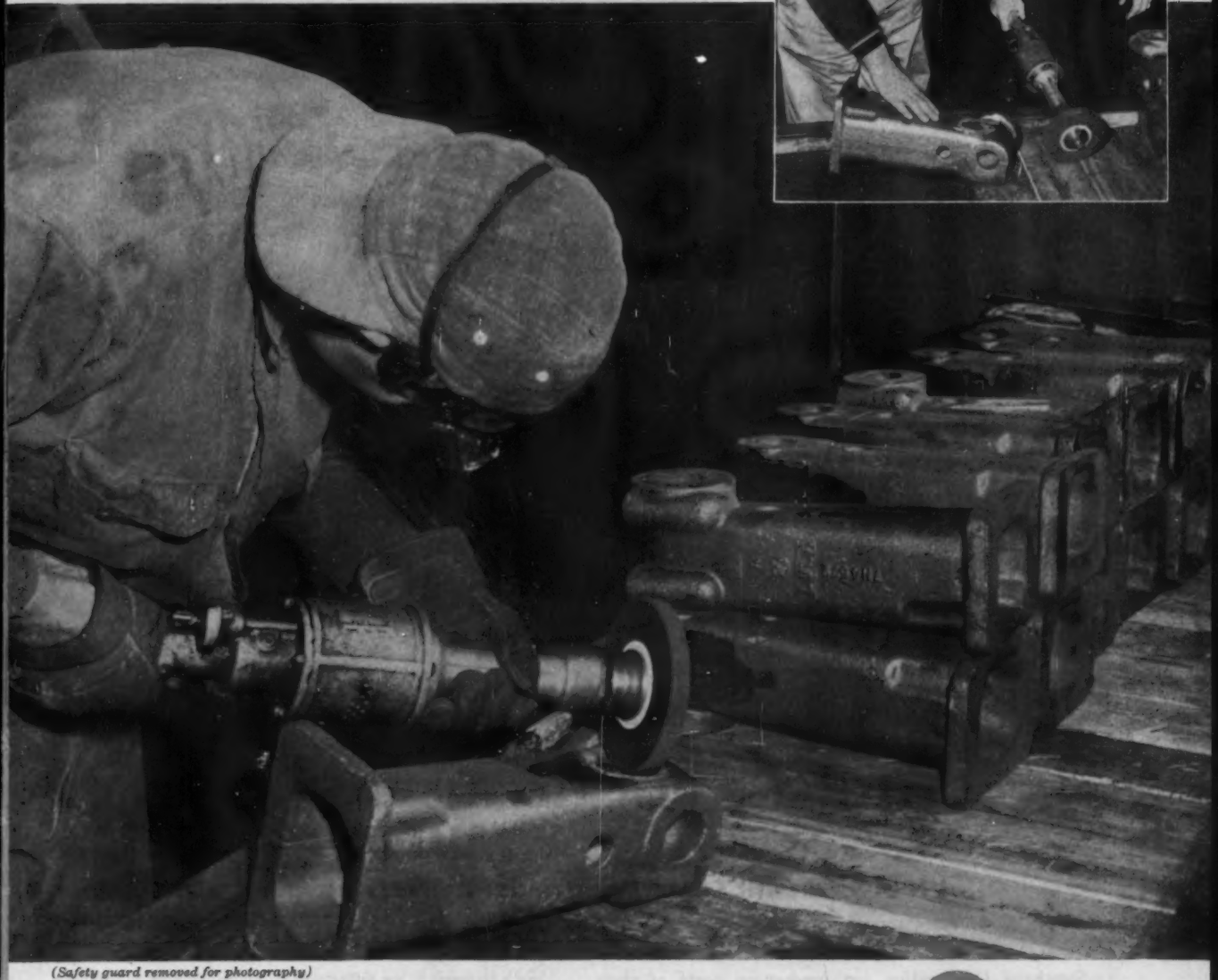
◀ CIRCLE 170 READER SERVICE CARD

▲ CIRCLE 171 READER SERVICE CARD

beat out all competition at OMAHA STEEL WORKS"

(Right) Chief Inspector Lloyd Base and Bay State Abrasive Specialist Gene Miller examine results achieved with Bay State finish-grinding wheel.

(Below) Operator Vincent Munsinger finish-grinds steel track-carrier casting with Bay State's 6 x ¾ x ⅝ wheel on a portable air grinder. "This wheel cuts fast and I don't have to change wheels too often," says Munsinger.



(Safety guard removed for photography)

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

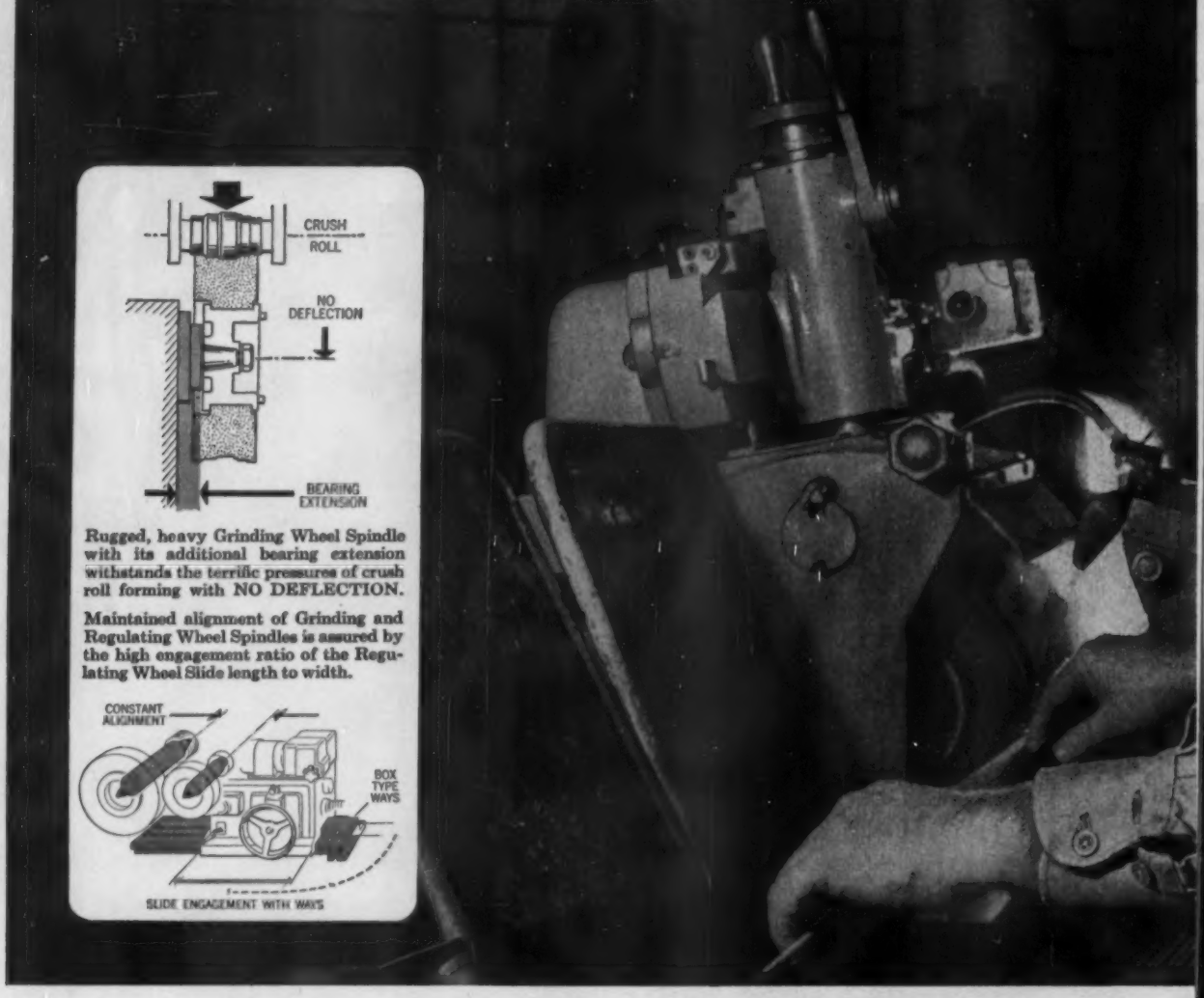
Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CIRCLE 172 READER SERVICE CARD

All industry is talking about the new Van Norman

Rugged, heavy Grinding Wheel Spindle with its additional bearing extension withstands the terrific pressures of crush roll forming with NO DEFLECTION.

Maintained alignment of Grinding and Regulating Wheel Spindles is assured by the high engagement ratio of the Regulating Wheel Slide length to width.



SYNTHANE PLASTIC TUBES FINISHED TO AUTOMATICALLY...

VN Diversimatic Centerless Grinder delivers greater precision, finer ... costs less to buy,

Synthane Corporation cut production costs of their small (under ½ inch O.D.) laminated plastic tubing when they switched to a VN Diversimatic Centerless Grinder. This low-priced, low-maintenance VN grinder is so exact that they can rely on machine accuracy to finish the tubing O.D.

Maintained Precision Assured—Secret of VN's exact grinding accuracy is its anti-friction grinding and regulating wheel spindles, which assure maintained precision in the workpiece under *any* conditions.

Faster Set-Ups . . . Increased Production . . . Greater Accuracy. The Van Norman Centerless Grinder is specifically engineered to produce more precision grinding work per operator per work shift . . . designed for in-feed

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS

EXACT TOLERANCES ECONOMICALLY

tolerances in small diameters less to maintain

work, thru-feed work, crush form grinding and profile work. The Van Norman Centerless Grinder is rugged, and designed for heavy duty, long run production.

Send For Free Booklet—"Centerless Grinding," your local VN Franchised Distributor will be happy to discuss how VN Centerless Grinding may increase production and cut costs for you . . . call him NOW.

MACHINE COMPANY

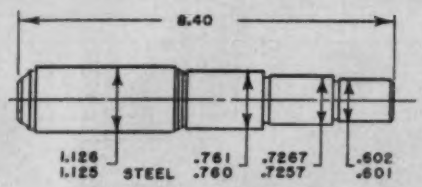
A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

2374

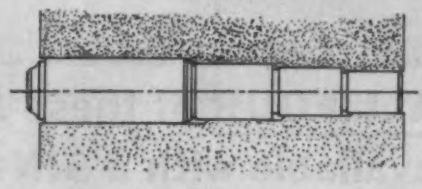
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



A prominent automobile manufacturer wanted to grind all diameters on worm shafts. The problem was more difficult because the part did not have the same hardness throughout its entire length. Automatic cycling was required as well as post-operational gauging with feed back to machine for size compensation.

VAN NORMAN SOLUTION:



A Centerless Grinder with a Hydraulic Diamond Dresser was used to grind this part. Three operations were used because of the large amount of stock removal required, and also because of intermediate operations such as hardening and thread milling. These operations were:

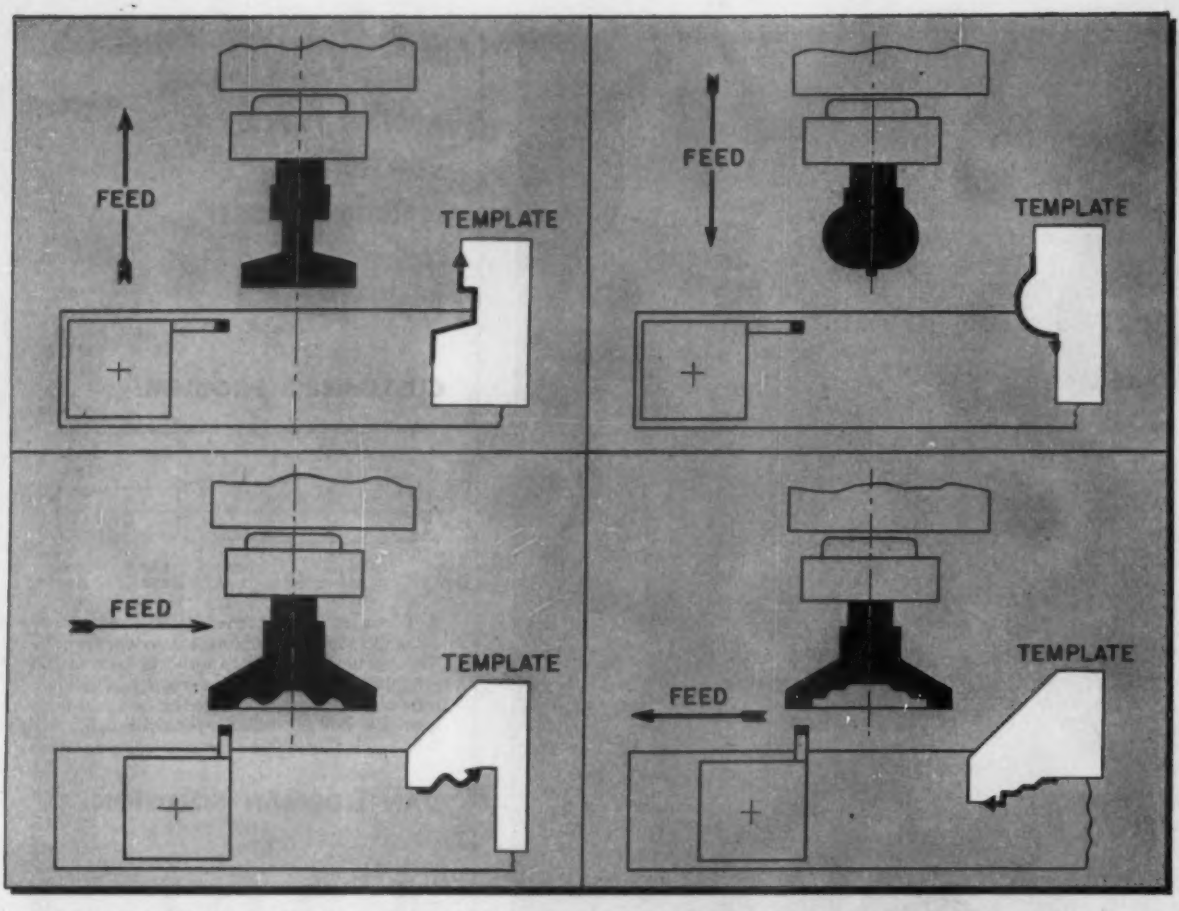
1st Operation—Grind all diameters to +.012/.011 in soft state.
2nd Operation—Grind all diameters to +.002/.003 after hardening.
3rd Operation—Final grind all diameters to size.

THE RESULT:

Complete customer satisfaction. The machine functioned as planned. Production was as follows:

1st Operation—120 pieces per hour at 100%.
2nd Operation—180 pieces per hour at 100%.
3rd Operation—240 pieces per hour at 100%.

Two Van Norman machines are now in use on this job.



ALL FOUR of these Automatic Tracing Cycles are available with a SINGLE Jones & Lamson Turret Lathe

the man who needs a new machine tool is already paying for it

How's this for machine flexibility in one chucking? (1) You get all of the accuracy and tooling combinations offered by the standard J & L Turret Lathe. (2) You have more than 180° of tool travel control in each of four different automatic tracing cycles (you don't *have* to have *all* four, incidentally). (3) You do both rough and finish tracing (*with rough and finish tools*) in the same set-up. (4) You multiple-tool your tracing operations through 180° of tool control. (5) You have complete control for diameter with the conventional graduated hand wheel on either mechanical or *tracing* operations. (6) The original full swing of the Turret Lathe is retained with this tracer. (7) A single lever disconnects the tracer for standard turret lathe operation.

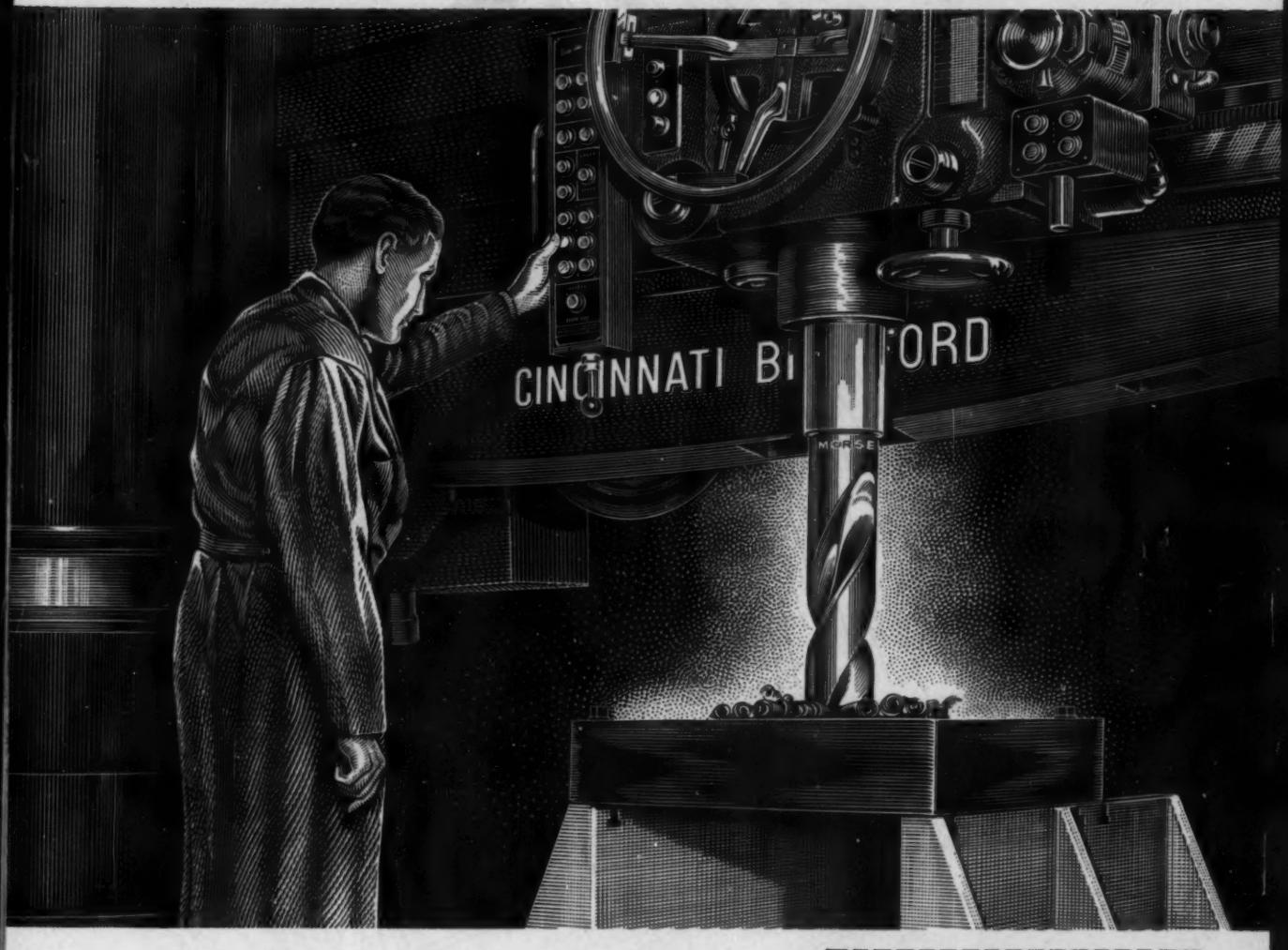
Such flexibility enables you to perform an amazing amount and variety of work with this new *Two-Dimensional Tracer* on J & L Saddle Type Turret Lathes.

It all adds up to: MAXIMUM WORK COMPLETED IN ONE CHUCKING; REDUCED HANDLING TIME; INCREASED ACCURACY. Write for further information.

JONES & LAMSON Machine Company • Dept. 710, 502 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

MORSE...CINCINNATI BICKFORD GIVE A SHOW OF STRENGTH



Morse tough tools easily take the thrust of world's most powerful radial drill... utilizes its full power.

Cincinnati Bickford caused many a drill manufacturer to throw up his hands when they looked for a drill tough enough to stand up under the thrust of the most powerful radial drill ever built. They found what they wanted at Morse... a regular taper shank drill right off the shelf.

Let Morse provide the easy solution for your tough jobs. Your Morse-Franchised Distributor will give you full details. Call him today.

Morse means more production... smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it... *specify Morse.*

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

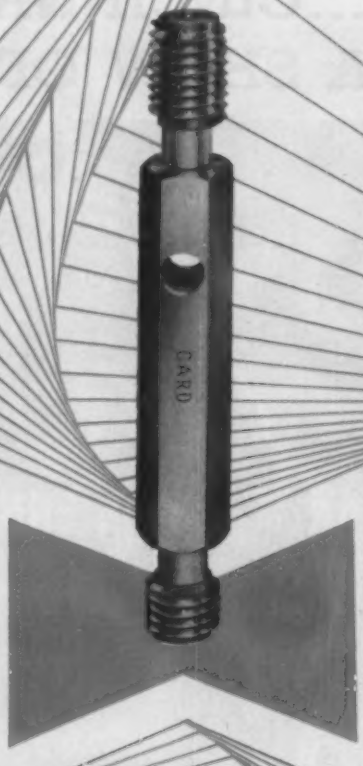
Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

VN

A Division of VAN NORMAN INDUSTRIES, INC.

CIRCLE 176 READER SERVICE CARD

CIRCLE 177 READER SERVICE CARD ►



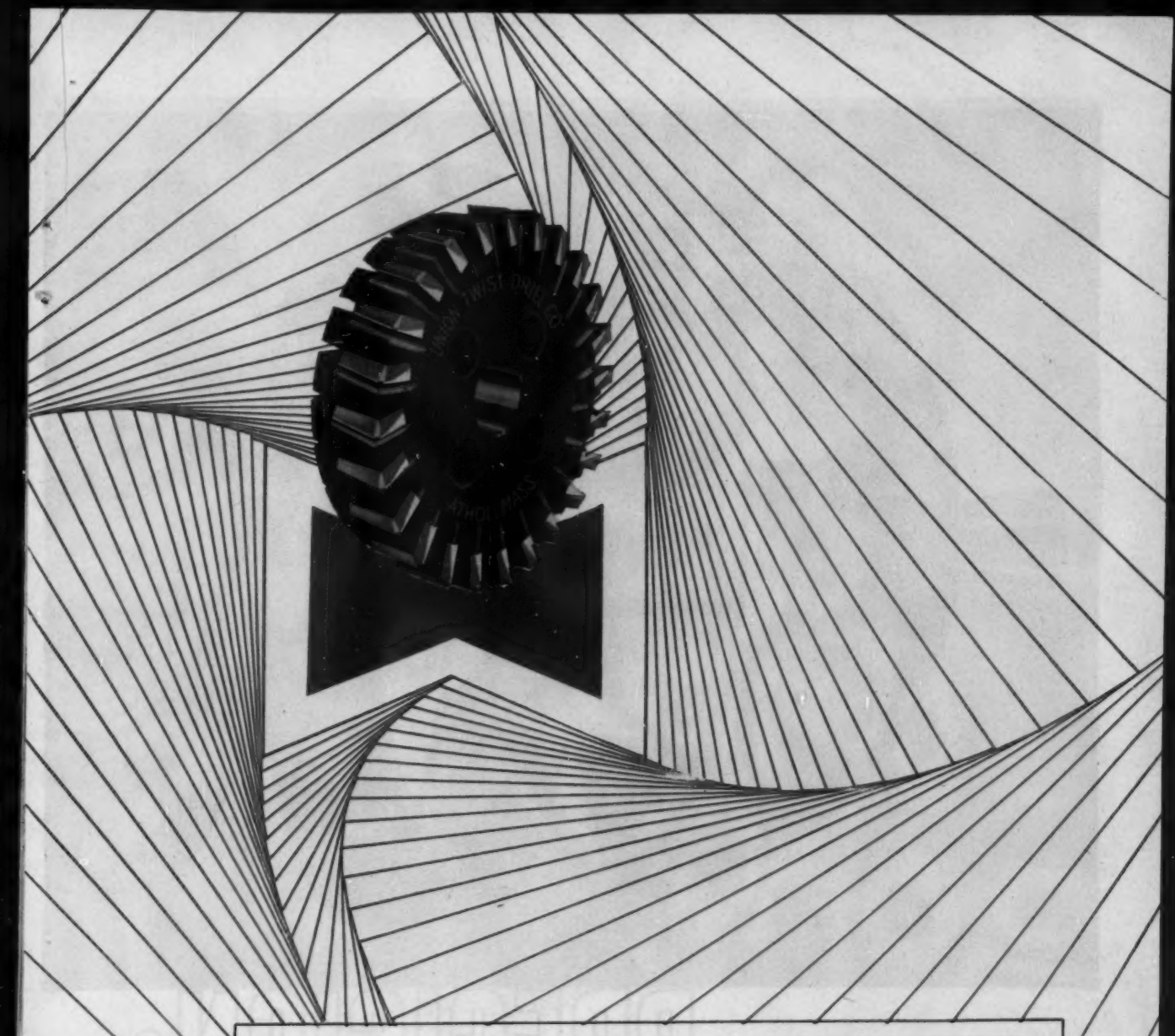
CALCULATED TO CUT COSTS

Geometric progression sets the pattern for exactly duplicating CARD gages. To users this assures consistently better performance and longer service life. Add these benefits to your own production by specifying CARD gages. Your CARD Distributor has a full line of gages, taps, dies and screw plates. For helpful advice on how to select and use them, see your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Production of UNION cutting tools is like geometric progression. Each UNION milling cutter of the same size and type is precisely duplicated. This exact duplication brings valuable production benefits to every user. For more dependable performance, longer service life, specify UNION milling cutters, drills, reamers, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

PRECISION:

Reason enough

Beryllium specialists, Leemath Incorporated of Long Island, create delicate and precise mechanisms in this high strength but toxic and abrasive wonder metal. In their temperature-controlled shop, this feather-light gyro float assembly (shown actual size, right) was turned on a special high-precision LeBlond Dual-Drive Lathe. *Spherocity had to be concentric with the two major axes within .0005" total indicated runout of 1.8750"!* (In order to hold the assembly that close, component tolerances had to be even tighter!)

To perform such touchy work, Leemath ordered their LeBlond 15" Dual-Drive to ultra-high precision standards. For this lathe Timken furnished specially-made bearings with one-third the runout of their finest precision class. With it came the standard features that give LeBlond its reputation for long-lived precision—combination gear-belt drive headstock with 16 speeds, 31 to 2400 rpm; compensating vee bed way construction with hardened steel shears; thrust-lock tailstock; and many more.

People buy lathes for many reasons. But when, like Leemath, they must have precision they can depend upon, that is reason enough to buy LeBlond.

If you would like to have the full story of LeBlond's Dual-Drive, ask your distributor or write for Bulletin 6A.

◀ CIRCLE 178 READER SERVICE CARD

▲ CIRCLE 179 READER SERVICE CARD

to buy LeBlond

LeBLOND of Cincinnati

THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

(Advertisement)

Open secret of New Britain superiority

Wide-open design makes the most fundamental difference between a New Britain automatic chucking machine and other machines. It speaks for itself as a means of getting at the tooling, making adjustments and clearing chips.

Massiveness, right from the floor up, is equally apparent and equally important in chucker work. You see it in the way the cutting tools make the heaviest cuts with a chatter-free smoothness that can't be duplicated.

Only New Britain provides a combination of longitudinal with transverse forming motion where needed. This versatility eliminates the need for second operation machines in many cases—particularly when a job is setup for double indexing for fast two-at-a-time production.

New Britain spares no pains to incorporate every new development to make chucker-type machining more profitable. The open-end design lends itself particularly well to magazine loading and unloading, for example, and many New Britains are being equipped to provide this feature.

Whenever a number of operations are required on cast or forged pieces, these massive, rugged, powerful machines offer great possibilities for savings through faster, more accurate, more reliable production. A new and complete catalog on the New Britain chucker line is just off the press. We would be very glad to send you your copy.

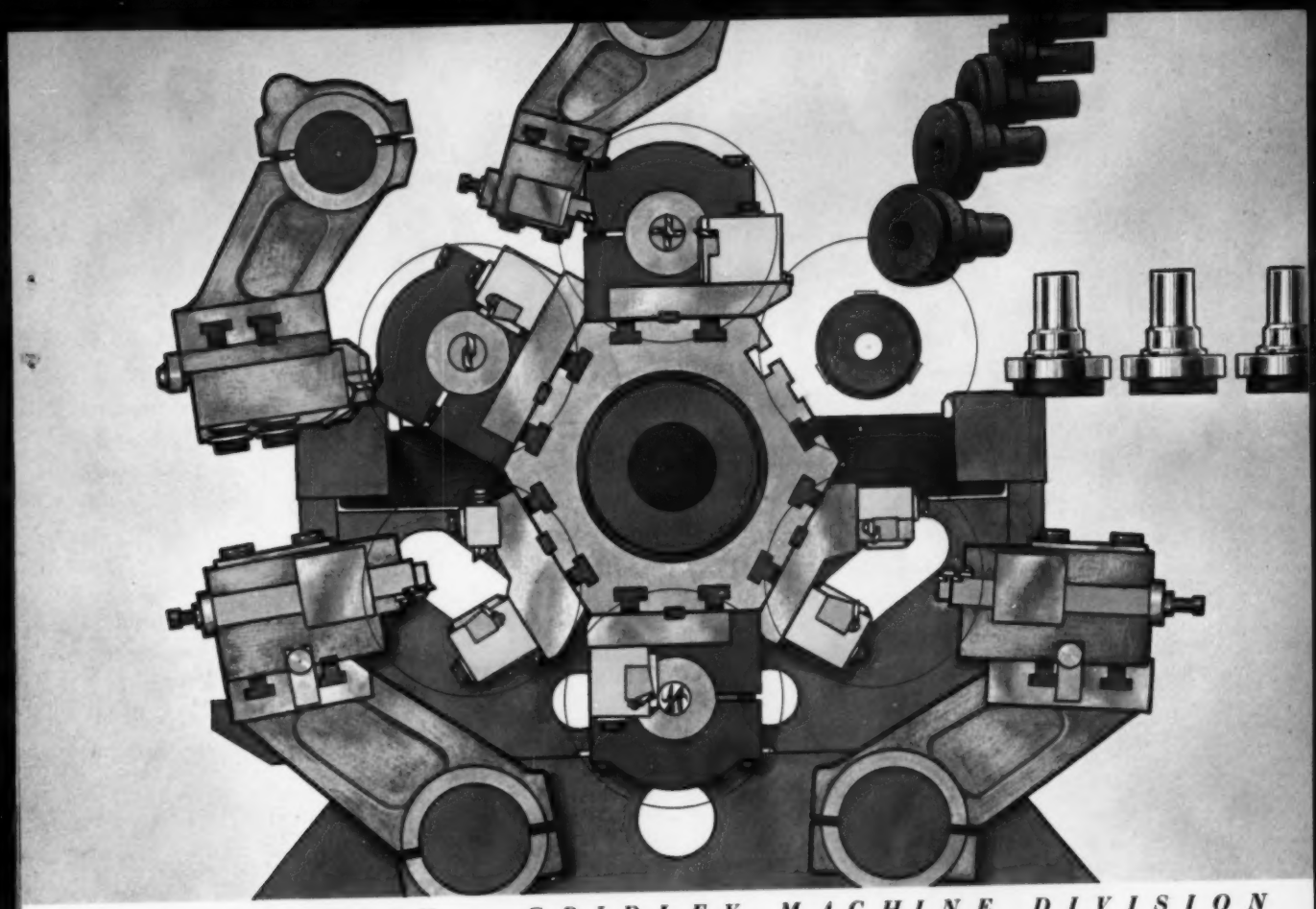
THE NEW BRITAIN MACHINE COMPANY

New Britain's answer to a serious threat

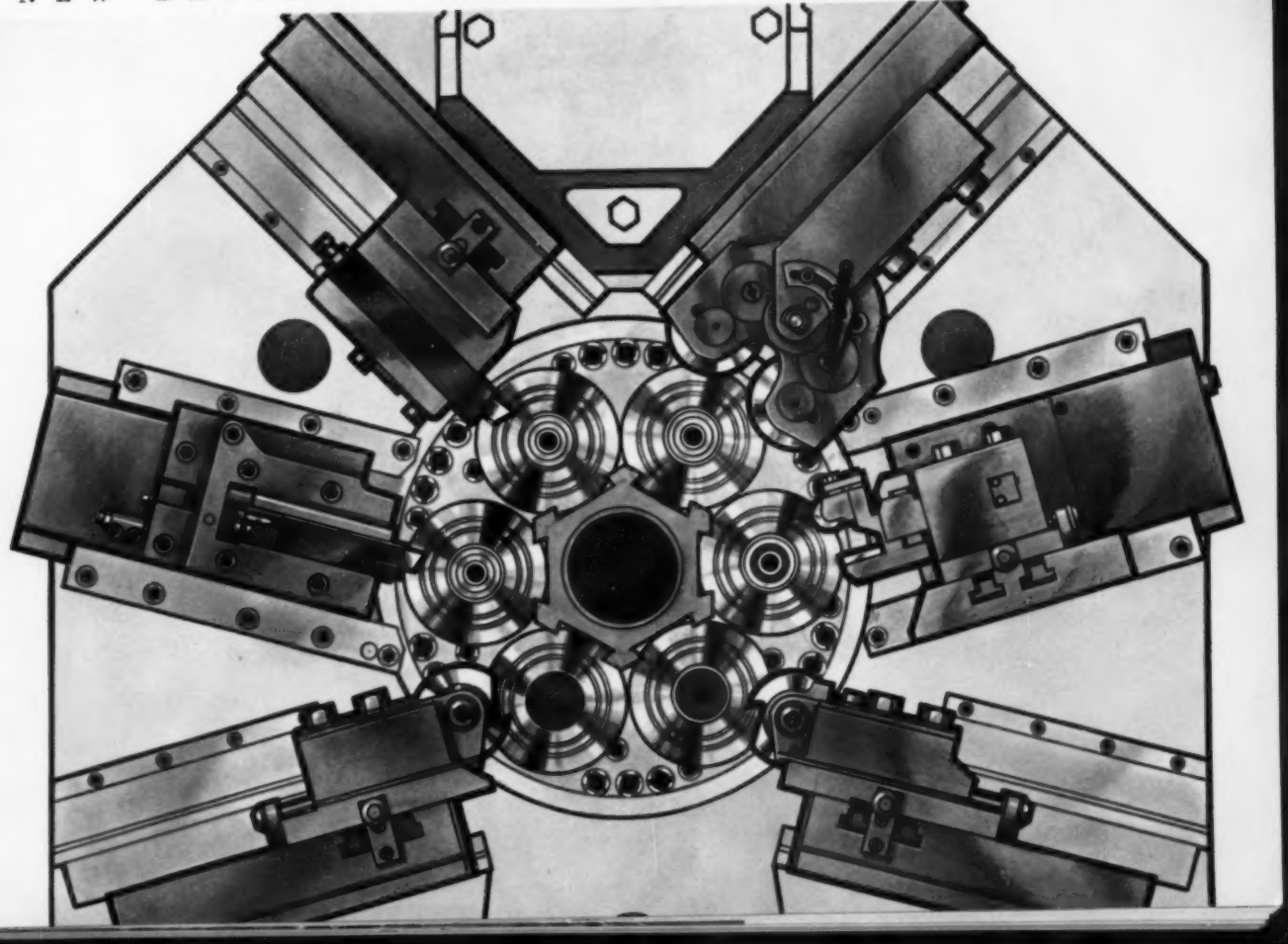
Overseas production of just about anything you care to name is making serious inroads on American domestic and foreign markets. It's no secret that European and Asian industry is catching up fast technologically—and they have a real competitive advantage in plenty of low cost skilled labor. While many foreign products are still inferior to those of domestic manufacture, this is far from true in all cases. The answer is, of course, increased productivity at lower cost.

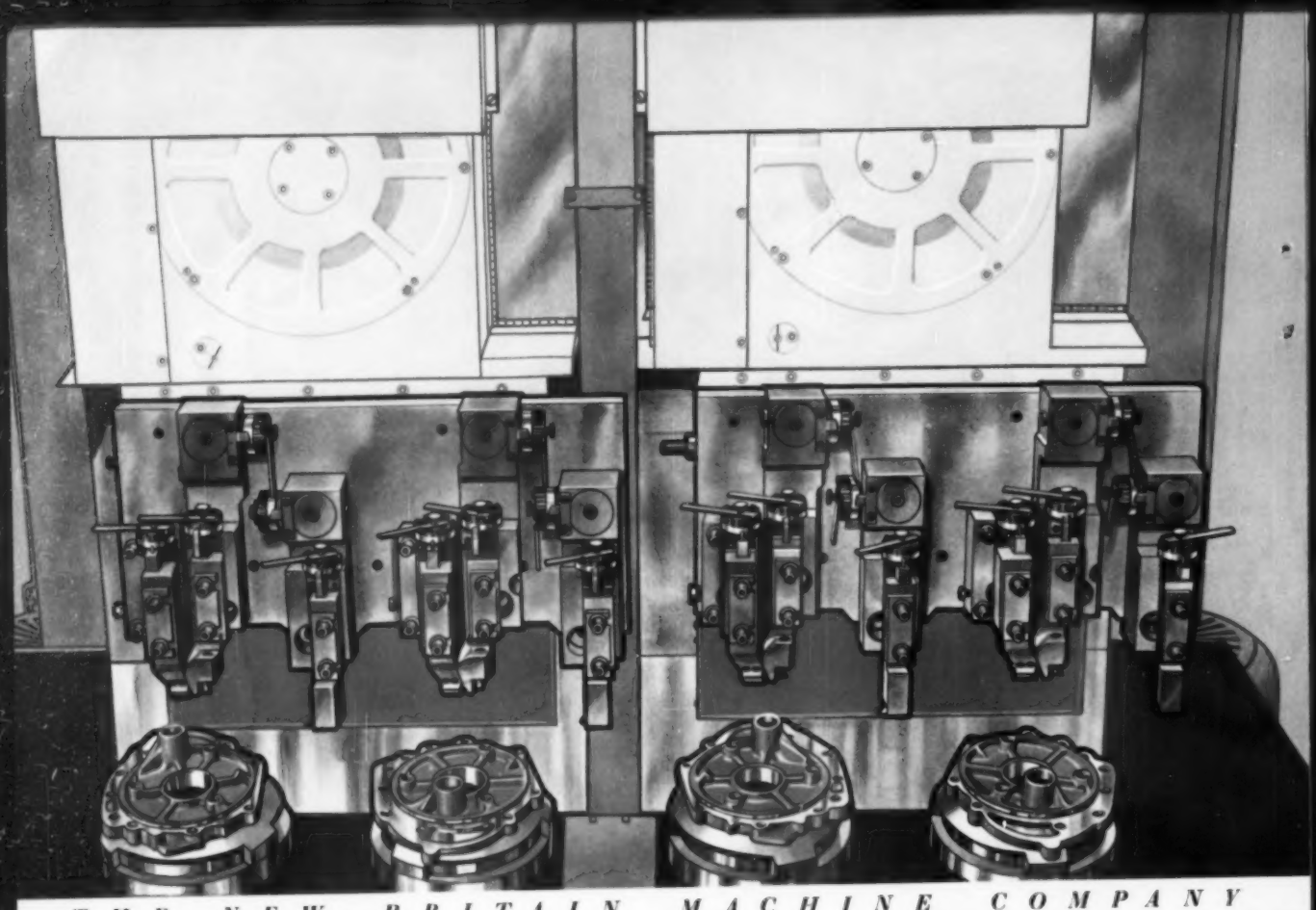
In its all-new line of bar machines, New Britain has developed the most modern bar-turning units available. Five models in two different series are offered with capacities from 1¼" to 5⅛". These machines are designed for really fast, trouble-free, high-precision production. More operations per machine are possible than ever before. Wide open tool areas allow unlimited combinations of end working and forming tools. New Britains will stay new longer. The exclusive wear-preventing features so familiar to New Britain users have been retained and improved. Catalogs on both the small and large series machines are yours for the asking. After looking this literature over if you think one or more New Britains may help improve your competitive situation, we will be happy to review your prints and arrange a demonstration. No obligation, of course. Call us or call your local representative.

New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

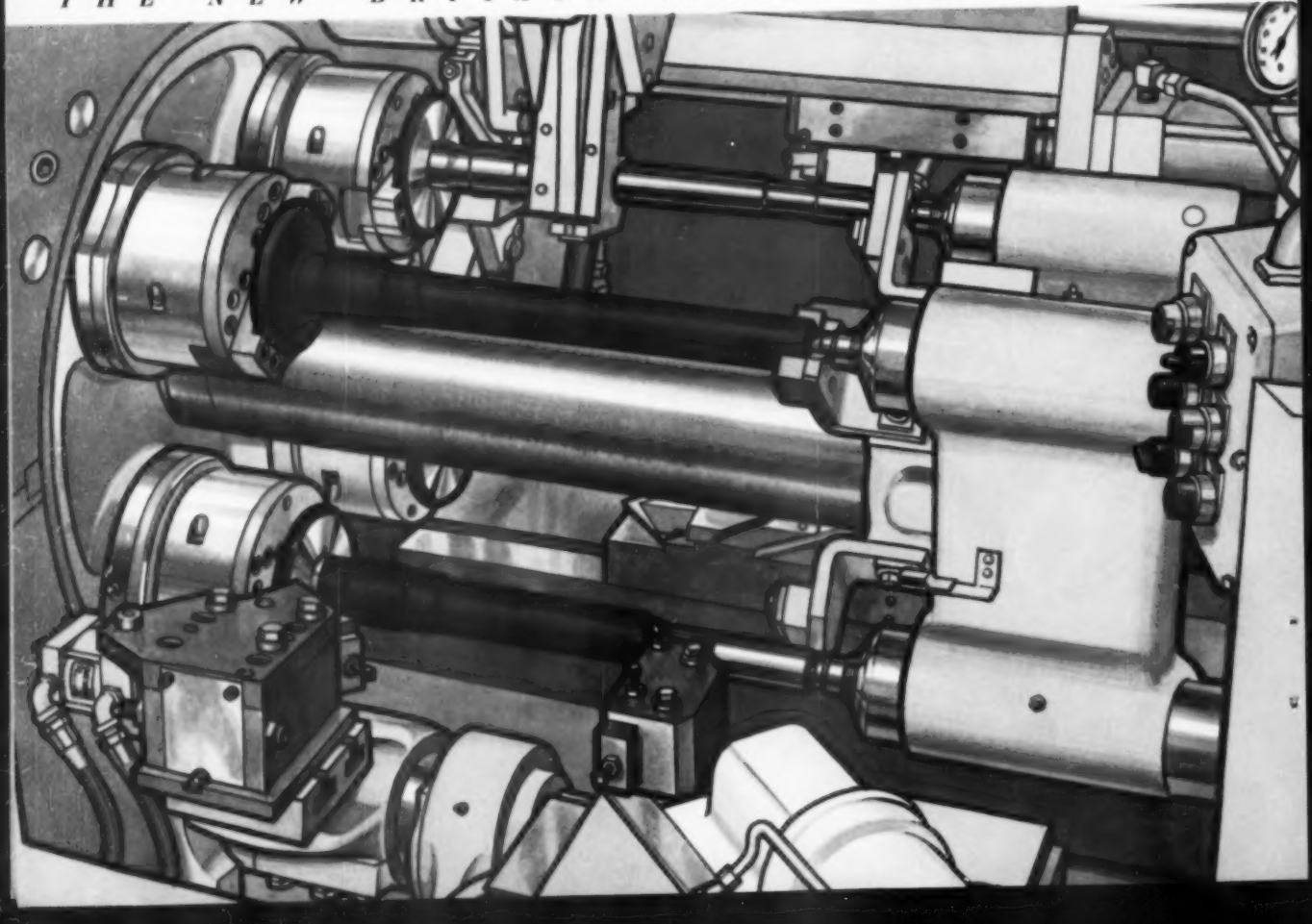


NEW BRITAIN · GRIDLEY MACHINE DIVISION





THE NEW BRITAIN MACHINE COMPANY



(Advertisement)

Precision boring
New Britain's new approach

New Britain Cam Actuated Vertical Precision Boring Machines offer an entirely new principle for more accurate boring and turning, plus compact exterior design and fast tooling. Rough cuts and finish cuts within close tolerances on the same set-up are characteristic. Standard models are available with maximum swing from 12" to 17¾" in 10 or 15 horsepower.

Here are a few of the major new developments incorporated in these unusual machines.

Greater accuracy. Both the vertical and cross slide cams are mounted on a common shaft which is contained inside the vertical slide. The linkages found in conventional cam-operated contouring machines are eliminated. Both the vertical and cross slides ride on preloaded roller bearings and are deflection-free.

Clean-sided design. Any number of these self-contained machines, each with one or more spindles, can be arranged side by side. Depending on how they are tooled, they operate either as a single unit or as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine, finishing both sides, completing *all* operations in one integrated, high-volume operation.

Fast tooling. Unrestricted accessibility allows rapid tool and cam changes.

Complete catalog material is available.

NEW BRITAIN · GRIDLEY MACHINE DIVISION

Idea for volume producers of shafts

Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years—up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25–a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Setup is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

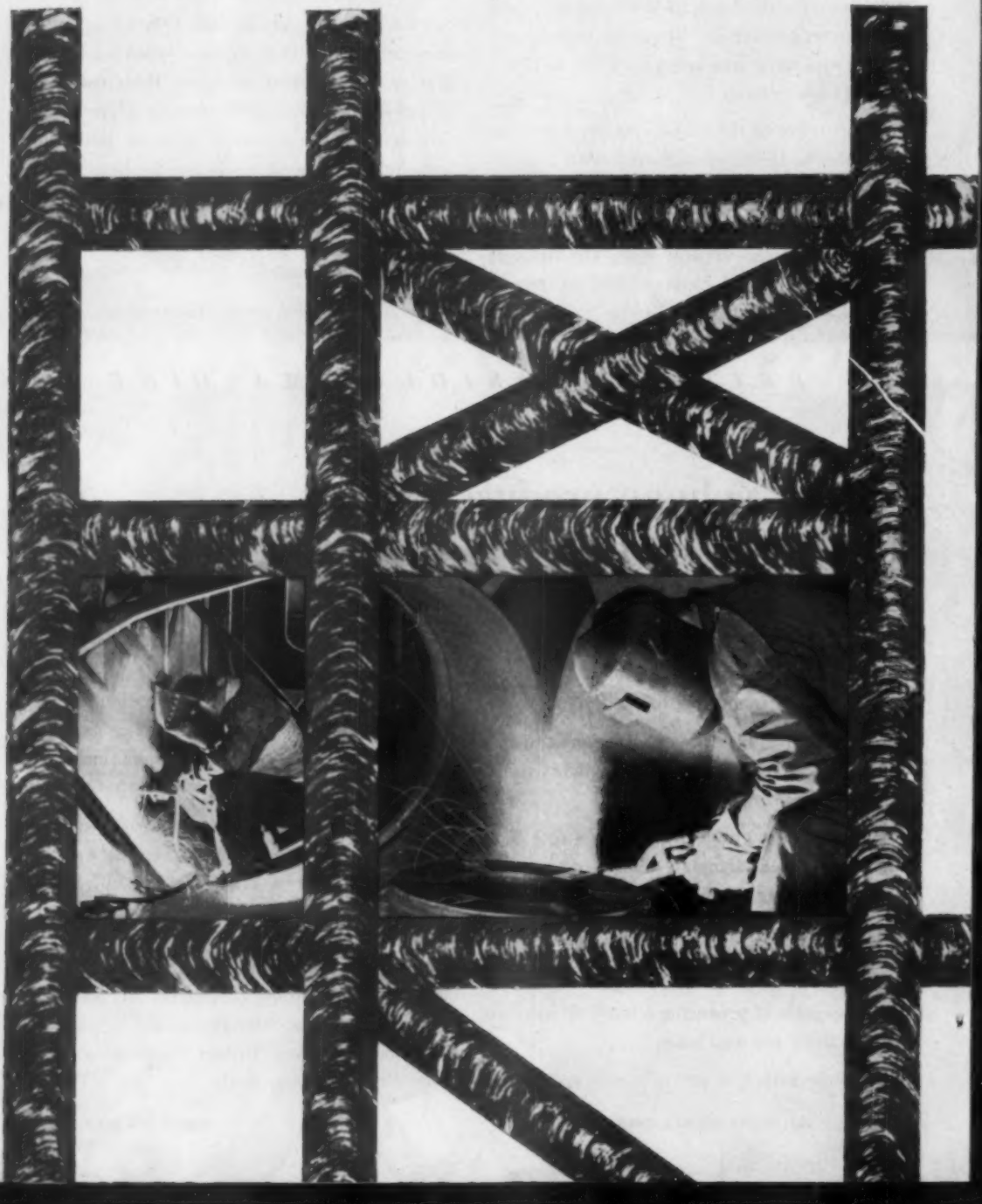
When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

◀ CIRCLE 183 READER SERVICE CARD

CIRCLE 184 READER SERVICE CARD

new Westinghouse iron powder-coated electrodes enable

For superior, faster, easier welding, try the new ZIP-10 electrodes—latest advance from Westinghouse research and development. Key to the ZIP-10's performance: a special iron-powder coating that helps boost welding speed . . . makes welding easier because of more spray-type metal transfer . . . permits instant restrike whether the tip is hot or cold. With ZIP-10 iron powder-coated electrodes, welds are smooth, strong, continuous . . . free from breakdowns, pin holes, puffing craters. Undercuts are reduced. Slag is simple to remove. And the ZIP-10 produces outstanding welds regardless of the position in which they are held.



faster welding, instant restrike, hot or cold

Check your nearest franchised Westinghouse welding distributor about the new ZIP-10, one of a series of iron powder-coated electrodes . . . as well as the other electrodes in the complete Westinghouse line. Write Westinghouse Electric Corporation, Welding Department, 4454 Genesee Street, Buffalo 5, New York, for a pocket-sized electrode selector booklet.

J-10482

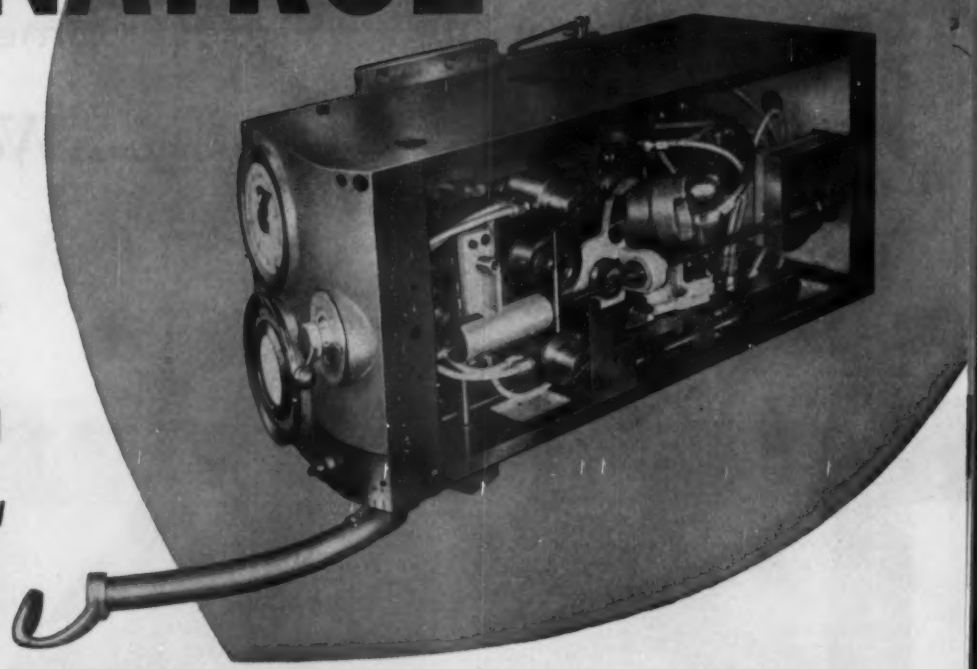
watch Westinghouse for new developments in welding

YOU CAN BE SURE... IF IT'S Westinghouse

CIRCLE 186 READER SERVICE CARD

This is the Heart of DYNATROL*

By means of a single lever or from a simple remote control all head motions, traverse and feed engagement are accomplished through this revolutionary new feed works.



Dynatrol* provides infinitely variable feed rates throughout the full range and variable traverse rates from zero to nine feet per minute. Feed rates may be advanced or retarded while the machine is cutting to obtain maximum tool performance and productivity. Ten sizes from 26" to 144" table diameter. Send to The Bullard Company, Bridgeport 9, Conn. for complete catalog.

High Spot Features of the Dynatrol* V.T.L. include:

VERSATILITY

Available equipment includes: Bullard variable speed drive for infinitely variable table speeds throughout the full range with no loss of usable horsepower. Fully automatic operation by Bullard Man-Au-Trol or point-to-point or continuous path numerical control systems.

Unique Size-Au-Trol* for accurate positioning of all heads. Contouring attachments: Hydraulic, electronic or electro-hydraulic. Four of five-sided power-indexing turret heads. Thread cutting, drum scoring and angle turning attachment. Power-operated chucks.

COMPACTNESS

The new Bullard Dynatrol V.T.L. is compact in design, rigid in construction, lower in height, reduced in floor area.

EASE OF MAINTENANCE

Automatic lubrication throughout . . . fewer parts . . . fewer adjustments . . . easily accessible.

*Trade Mark

"YOU CAN'T BEAT A BULLARD" BULLARD

A NEW Band Saw Machine that Cuts Down Cut-off Costs

Get the Complete Dollars-and-Cents FACTS . . .

. . . and see for yourself why the many exclusive design and construction features built into the Milband Band Saw Machine Tool will give you important benefits like longer blade life, faster cut-off sawing, increased production, greater accuracy and lower cost-per-cut.

The Milband is specifically designed and built to provide the extra ruggedness, rigidity and construction refinements needed to operate high speed band saw blades with full efficiency. Facts about this machine – including comparative time-and-cost figures obtained from actual performance tests – are featured in the new circular shown here. Use the handy coupon below to send for your free copy . . . today! There's no obligation, of course.

MILBAND MACHINE TOOL DIVISION

THE HENRY G. THOMPSON & SON CO., NEW HAVEN 5, CONNECTICUT

Saw Specialists for Over 80 Years

THE HENRY G. THOMPSON & SON CO.
271 Chapel Street New Haven 5, Connecticut

Gentlemen: Please rush my free copy of Thompson Circular No. 502, giving the complete facts on fast, low-cost production cut-off sawing with the MILBAND Band Saw Machine.

Name_____ Position_____

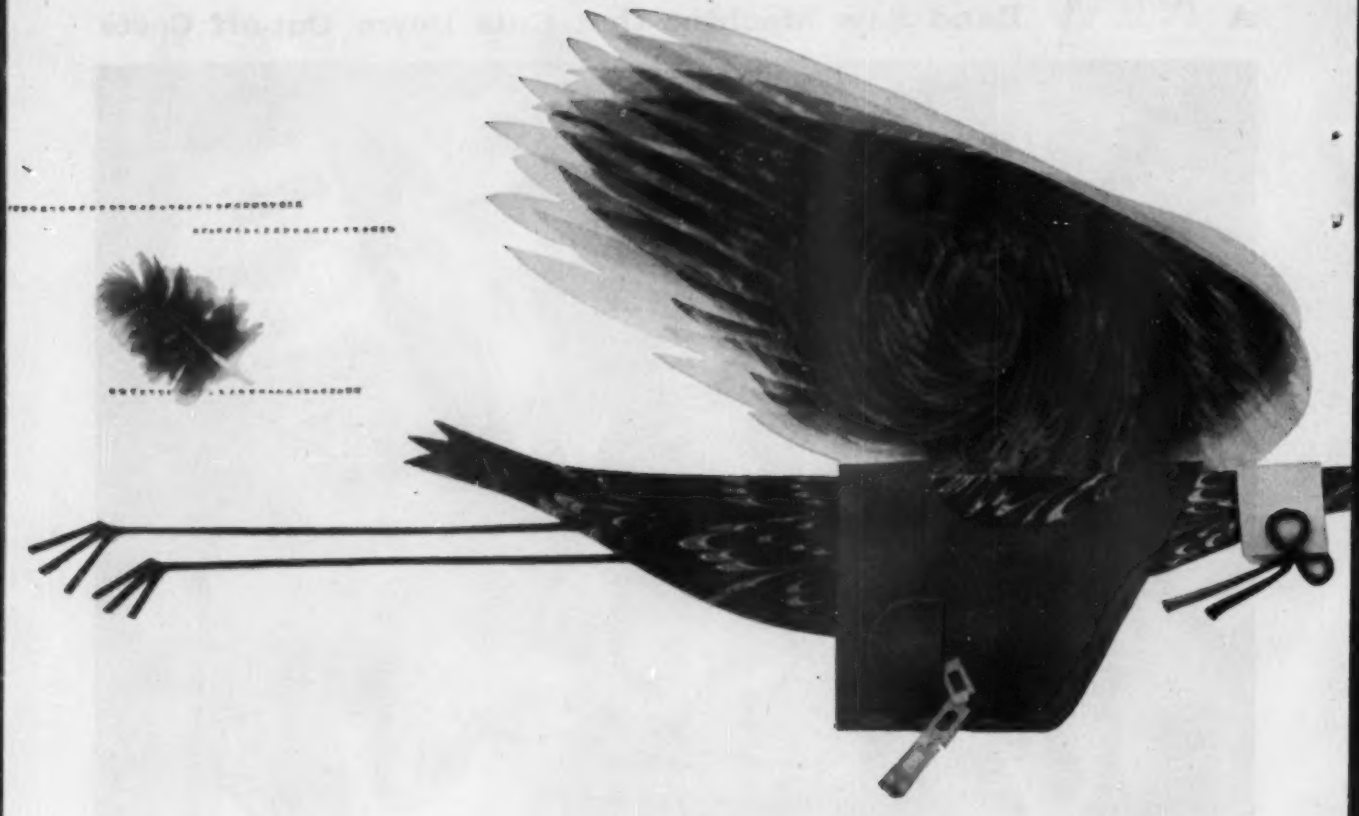
Company_____

Co. Address_____

City_____ Zone____ State_____

◀ CIRCLE 187 READER SERVICE CARD

CIRCLE 188 READER SERVICE CARD



BUHR'S "BABY".....

The first major equipment built to the Special Machine Tool Standards is on the way. And it's Buhr's Baby! A lift-and-carry type transfer that will perform 323 precision operations, Buhr's Baby will be the most flexible and readily convertible multiple operation machine tool ever built. Manufacturing was started in December. Future ads will keep you posted on progress.

BUHR MACHINE TOOL COMPANY • ANN ARBOR

Report to the **SMTS** *Committee*

is ...on the way!

BUHR

MICHIGAN **ECONOMATIC**

NATIONAL ACME'S

"ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS...Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Minneapolis Honeywell . . . an "every day" job for Acme-Gridleys.

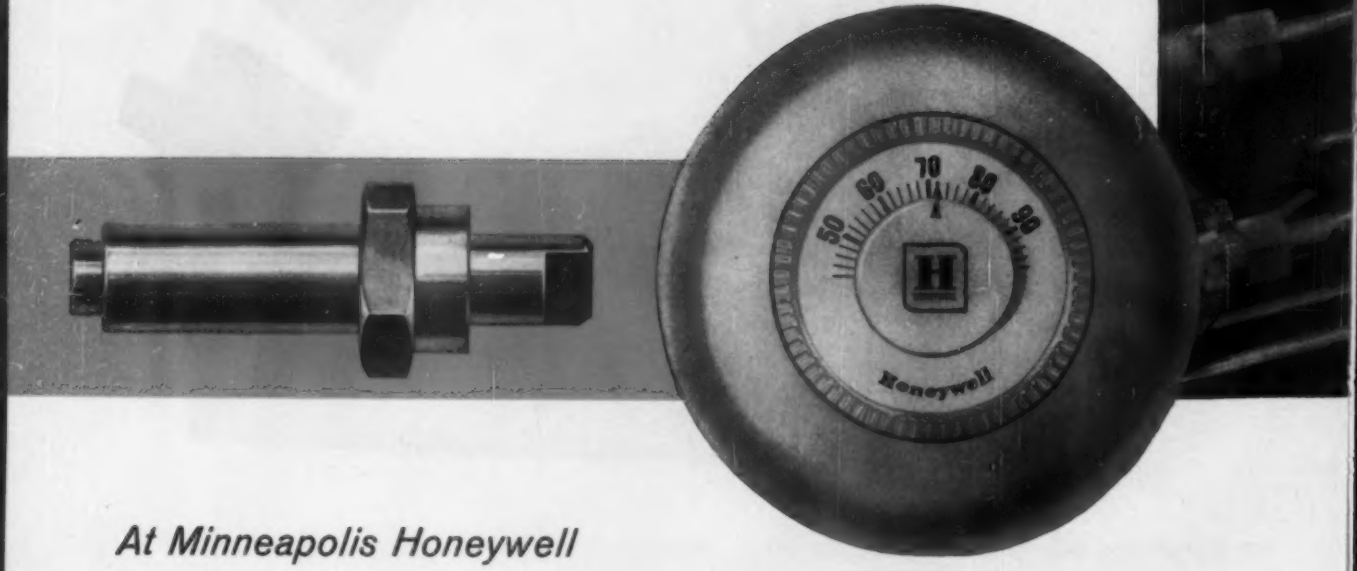
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

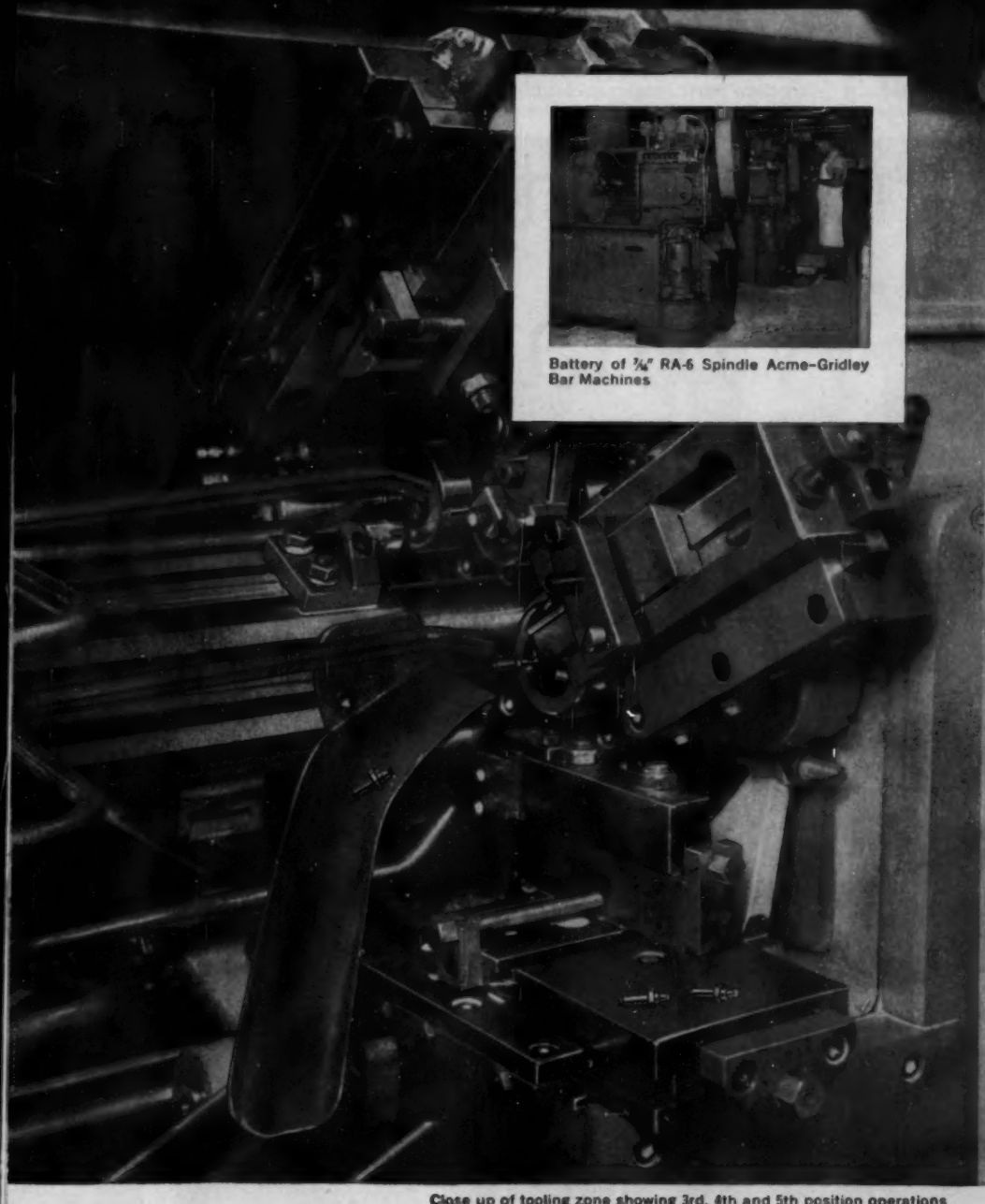


At Minneapolis Honeywell

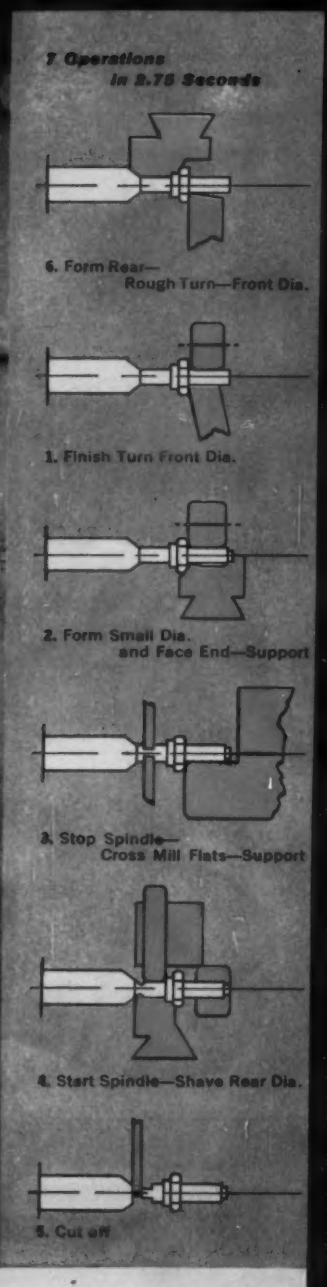
ONE ACME-GRIDLEY REPLACES FIVE SINGLE SPINDLE MACHINES

. . . Saves 80% in Machine Hours

CIRCLE 191 READER SERVICE CARD



Battery of ¾" RA-6 Spindle Acme-Gridley Bar Machines


7 Operations in 2.75 Seconds
6. Form Rear—Rough Turn—Front Dia.
1. Finish Turn Front Dia.
2. Form Small Dia. and Face End—Support
3. Stop Spindle—Cross Mill Flats—Support
4. Start Spindle—Shave Rear Dia.
5. Cut off

Close up of tooling zone showing 3rd, 4th and 5th position operations

. . . *in addition* the reject rate is reduced 83% and operator hours per thousand slashed 92% in the production of a precision center post component for residential thermostats. What's more, with one machine, one set of tools, and one operator doing all machining in the primary setup, quality control is greatly simplified, and valuable floor space saved. Still further savings result from greatly reduced machine maintenance.

Such drastic savings are possible for Minneapolis Honeywell because of inherent Acme-Gridley features such as independently operated tool slides, the extreme accuracy and flexibility of direct camming, and wide open tooling zones. Rugged and versatile 7/16" Acme-Gridleys fit right in with Honeywell's program of "Total Machine Utilization"; will pay off for years to come by economically accommodating the materials and setups Honeywell requires in the production of small, high quality parts for their precision instruments.

Get the complete story on how Acme-Gridley Automatics provide industry's most modern approach to cost reduction. Call, write or wire.

Pioneer in Circumferential Automation

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J.; Chicago 6, Ill.; Detroit 27, Mich.

CIRCLE 192 READER SERVICE CARD

It's a Push-Button World at Williams

No other manufacturer has the combination of automated equipment to make the finest fit, feel and finish in wrenches!

Forging temperatures for each of Williams' 65 hammers are automatically controlled by sensitive pyrometric instruments which comply with rigid aircraft specifications, MIL-Q-5923C (USAF). The result is tough, fine-grain forgings every time. Die matching is held to close tolerances for maximum structural uniformity.

Special conveyorized heat-treating equipment automatically heats and quenches forgings in a series of salt baths to prevent decarburization and dimensional distortion often found in other wrenches. It further develops the relationship of toughness and hardness to the optimum.

CIRCLE 193 READER SERVICE CARD

Feel and finish are refined on this automatic profiling machine. All rough edges are completely removed. Wrench handles are profiled to uniform dimensions and are blended into the heads for greatest strength.

Here wall thicknesses are machine-controlled to exact concentricities. This extra step produces heads offering uniform clearances from wrench to wrench... pattern to pattern.

Developed specially for Williams, this three station transfer machine drills, broaches and chamfers. Box openings are machined to tolerances well within industry standards for long-lasting, sure-grip fit.

WILLIAMS' SUPERIOR DESIGN OUT-PERFORMS EVERY OTHER WRENCH

12 Point openings, broached to close tolerances, permit complete nut rotation in 30°

Modified rectangular handle-design offers maximum strength and comfort.

Wall thicknesses designed for maximum strength with greatest clearance.

Satin finish for safe, firm grip. No dirt-catching ornamentation.

Height of box wall correctly proportioned for all nut sizes and series.

Offset forged-in from top of box for the maximum obstruction clearance.

Williams Wrenches measure longer than industry average for extra leverage

MR. WRENCH says:

SEND FOR THIS NEW JAM-PACKED CATALOG No. 304. Lists 4530 stock tools and forgings...wrenches of all kinds, power sockets, clamps, tool holders, hoist hooks, eye bolts, and many more...

THE BROADEST LINE OF ITS KIND

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 **Vulcan Street, Buffalo 7, New York**

Mr. Wrench: Please send me your new illustrated catalog No. 304.

NAME _____ TITLE _____

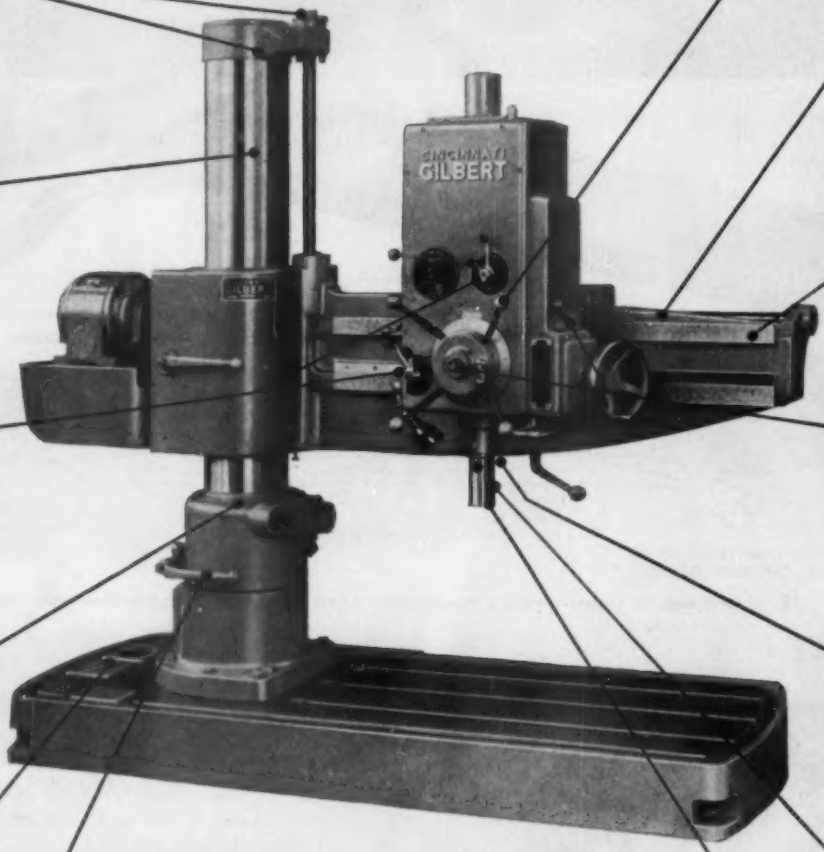
FIRM _____

ADDRESS _____ ZONE _____ STATE _____

ONLY GILBERT RADIALS

OFFER ALL THESE FEATURES

When you order a Cincinnati Gilbert radial, you get more new features per dollar than any other radial can offer. And every feature is designed to give you maximum return on your investment—in performance, productivity, and dependability.



- Safety elevating nut protects both operator and machine
- Weight carried on opposed Timken bearings
- Hardened column available
- Direct-reading speed and feed shifters; gears counterbalanced for easy shifting
- Adjustable ball bearing rollers on hardened ring for maintained rigidity
- Long heel on heavy base provides 360° stability
- Powerful, accurate electric column clamp available
- Four-lever turnstile cuts machine handling time
- Balanced arm resists torsion, compression, tension forces
- Head rides on anti-friction bearings; clamps three surfaces
- When disengaging positive feed clutch, spindle won't drop
- Full spindle support near tool; runout is less than .001"
- Hardened tang slot is an exclusive Gilbert feature
- You can always see the spindle; get extra use of spindle travel

And don't overlook these additional features:

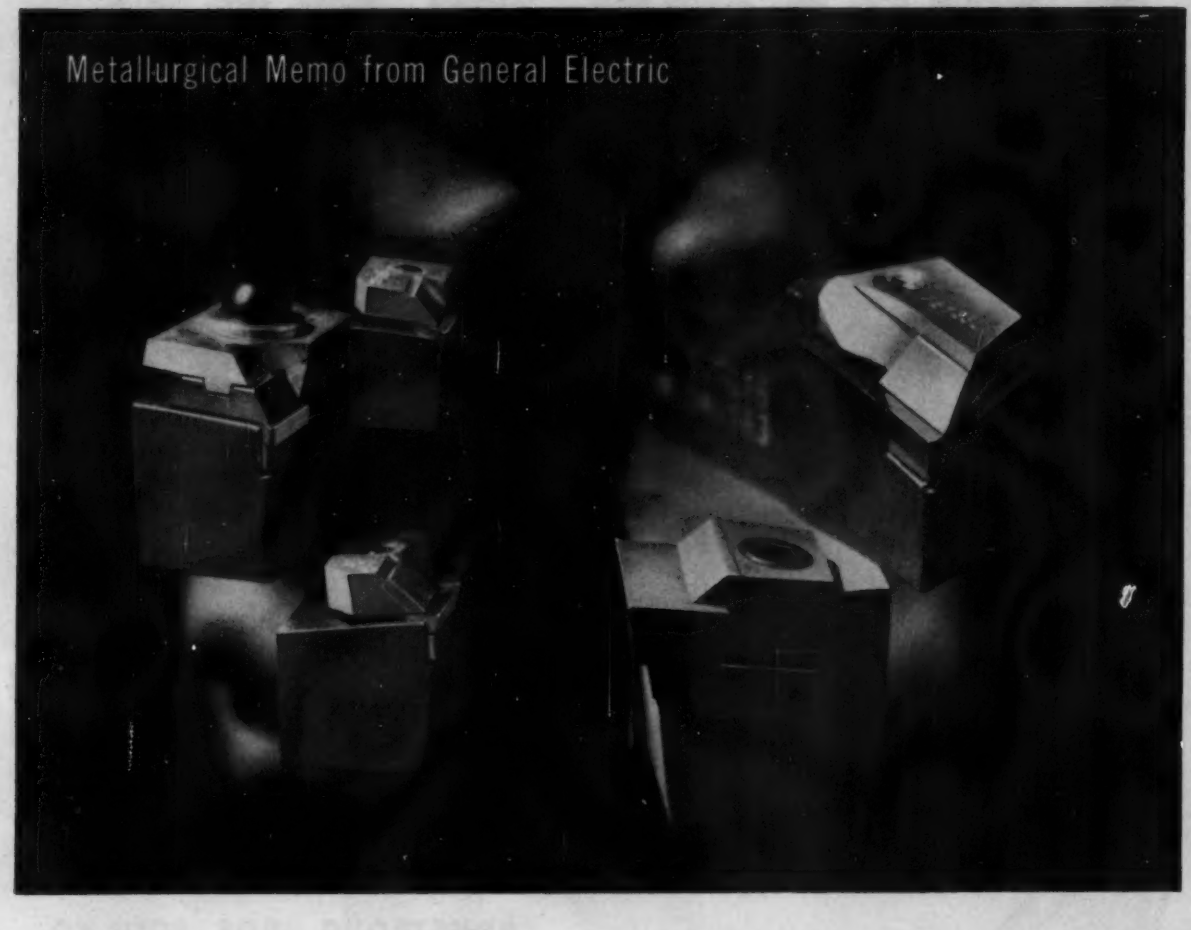
- wide range of spindle speeds for efficient tool performance;
- hardened gears throughout the machine;
- standard or special tap leads available;
- modern styling which reduces housekeeping, convinces customers that your shop is up-to-date.

Write or call for Bulletin 349.

those who buy Gilbert buy Gilbert again

THE CINCINNATI GILBERT MACHINE TOOL CO.
3340 BEEKMAN STREET, CINCINNATI 23, OHIO

CIRCLE 195 READER SERVICE CARD



Pick the one you need . . . there's a G-E Carboloy toolholder for every metalcutting purpose

Designed to do a better job more efficiently, Carboloy toolholders help you get BETTER PROFITS THROUGH BETTER TOOLING

Even the very finest cemented carbide inserts (Carboloy carbides) can't do a decent machining job if the toolholder is inferior.

That's why the Metallurgical Products Department of General Electric has evolved a line of toolholders to do a superior job in every metalcutting operation. Carboloy toolholders get the mileage out of inserts . . . take the headaches out of machining.

Choose from: Lift-O-Matics, with self-raising chipbreaker clamp (positive rake, negative rake – 20 styles, 186 sizes total); Adjust-O-Breakers, with the chipbreaker versatility of *many* toolholders (negative rake – 10 styles, 30 sizes); Tracers (positive rake, negative rake – 8 styles, 19 sizes total); Heavy-duty (8 styles – 10 sizes).*

These, along with the complete line of Carboloy inserts, insert seats, convertible seats, and brazed tooling, are all designed to help you attain "BETTER PROFITS THROUGH BETTER TOOLING." Check with your Authorized Carboloy Distributor today. Or write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Road, Detroit 32, Michigan.*

**Available through Canadian General Electric Company, Limited, Toronto, Ont., and through International General Electric Company Division, General Electric, International, New York, N.Y.*

CARBOLOY.
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD . . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and aligned with machined seats; have sliding pin handles and free-acting swivel caps on point. Bodies have smooth sandblast finish.
(8 sizes to 12" opening)

Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools.

ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

HEAVY DUTY "C" CLAMPS

Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiplies thread friction against loosening. Extra large screws are heat treated and hardened at point.
(11 sizes to 1½" opening)

MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and swivel cap on point. Ground seat.
(9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or "swivel" screw types.
(Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS

Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
(8 sizes Capacities to 12" opening)

MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
(Four sizes: Capacities to 4½" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
(3 sizes: Capacities to 2½" opening).

MMT-PE

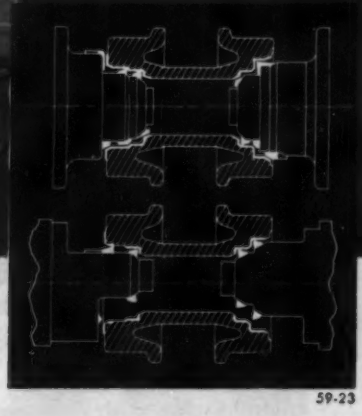
FROM ROUGH...

Heavy boring and plunge-facing

TO FINISH

Precision boring and facing

IN ONE MACHINING CYCLE



59-23

Ex-Cell-O Custom Machine—with quick-change tooling—speeds output of large, cast-iron track rollers

This Ex-Cell-O Custom Machine features precision—in a big way.

A track roller for rugged, off-the-road equipment, is clamped in the hydraulically-actuated fixture; the rest—from rough to finish—is automatic.

The part is first rough-bored on both ends at the same time. Then both slides retract and the fixture indexes into position for finish boring and facing at both ends, simultaneously. (Drawing, above-right, shows rough and finish tooling.) Slides again retract and the fixture is unclamped, ready for the next cycle. Easily changed tooling heads and clamping jaws permit precision machining of any of three similar components with minimum lag in production.

See your Ex-Cell-O Representative, or write direct for full details on Ex-Cell-O Custom Machines—specially designed with extended capacity for changing production needs.

EX-CELL-O FOR PRECISION XLO

MMT-PE

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE 198 READER SERVICE CARD

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier. *ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. AM-271.*

WBW-7250

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

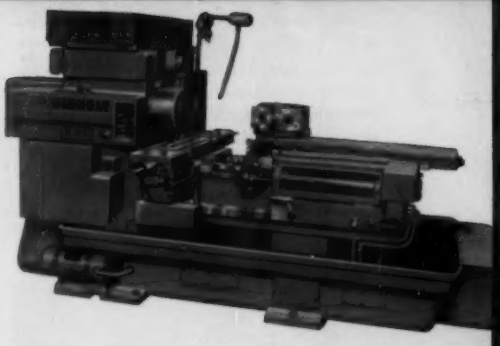
PRODUCTION POINTERS

from GISHOLT

MASTERLINE GISHOLT SINCE 1887

NEW GISHOLT AR LATHE SAVES GRAY COMPANY 50% ON BAR AND CHUCKING JOBS

New No. 5AR (Automatic Ram) speeds machining, improves quality, lengthens tool life on job lots and production runs



"Why buy two when one will do?" That was the basic reasoning used by Gray Company, Inc., Minneapolis, Minnesota, in selecting an automatic to replace hand-operated machines for bar and chucking work. This firm found the ideal answer in the new Gisholt AR—*the first truly automatic ram type turret lathe.*

The new No. 5AR turns out parts 50% faster, on the average, than manually operated turret lathes. Operator fatigue is eliminated with the automatic cycle. Tool life is longer; work quality and production rates are consistent; tolerances are easily held.

Gray Company manufactures the well-known "GRACO" line of air-powered pumps for transfer and application of materials, and automotive servicing equipment. Here is how a typical job, a cast iron reel hub, is handled on the new 5AR. The work is machined in two operations. Only the second operation is illustrated. The operator chucks on the O.D., locating against the previously machined face. Multiple tooling on the hex turret drills, shave-faces, turns the O.D. and the pilot diameter. Tooling on the second station finish-bores. The cycle stops at station 3, which is blank, providing ample space for loading and unloading. Front and rear cross-slide tools operate at separate times with the two turret stations to step-face the work. The turret is double-tooled to finish two pieces with each complete index. Finish ranges from 100 to 125 micro-inches RMS. A tolerance of +.000", —.001" is held in the bore.

Compare these production rates

Operation 1

Manual turret lathe	14 pcs./hr.
New AR turret lathe	26 pcs./hr.

Operation 2

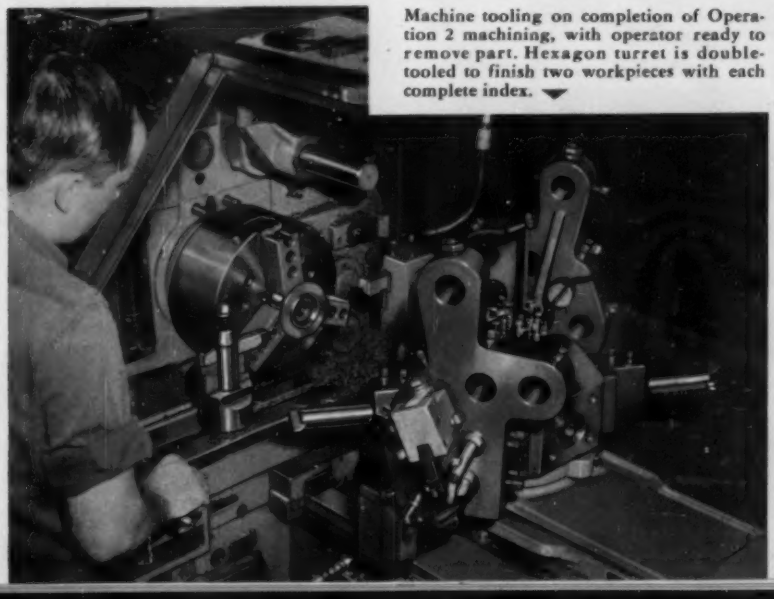
Manual turret lathe	34 pcs./hr.
New AR turret lathe	55 pcs./hr.

The new Gisholt AR Turret Lathe combines automatic cycle efficiency with the versatility and quick setup of the hand-operated ram type turret lathe. The automatic cycle frees the operator to handle another machine or do other work, in most cases greatly increasing productivity.

The Gisholt AR converts from chucking to bar work in approximately one hour. Aside from cycle programming, there are no new machine setup procedures to learn and no gears to change. It uses standard tools, available in most shops.

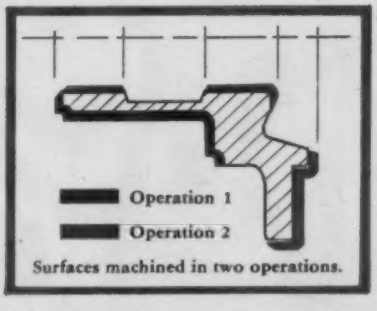
It sets up fast. Machine functions, electrically or hydraulically controlled, are preselected for each turret station. This includes spindle speeds, indexing, traverse and feed of the turret, and independent operation of the cross slide. An experienced operator learns to set up his own cycles in approximately one day.

To get the complete story on the versatility and economy of the AR—the new automatic ram costing little more than hand-operated machines—contact Gisholt.



Machine tooling on completion of Operation 2 machining, with operator ready to remove part. Hexagon turret is double-tooled to finish two workpieces with each complete index.

Left—rough workpiece; center—after first operation; right—after Operation 2.



Surfaces machined in two operations.

For complete information on new Gisholt AR, circle No. 708 on Reader Service Card.

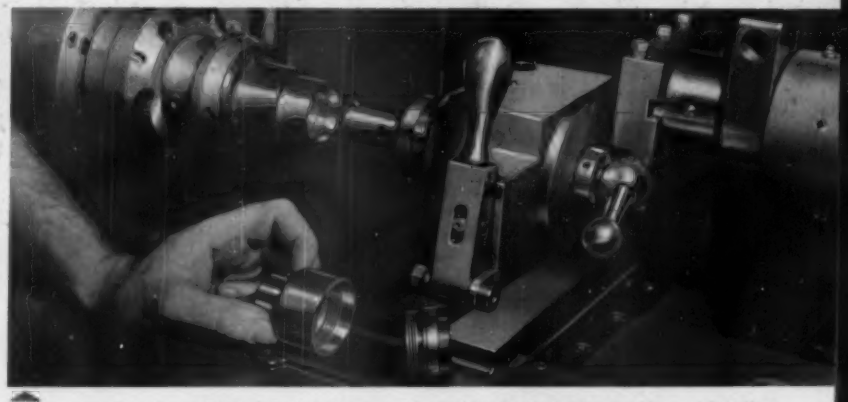
CRI-DAN THREADS COMPLEX PARTS 100% FASTER FOR BELL AND HOWELL

Two-start Class 4 threads and 32 micro-inch RMS finish produced by simple tooling setup

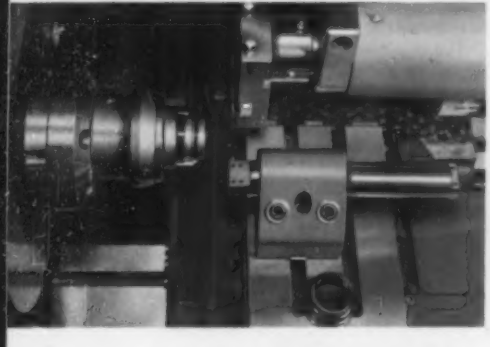
Looking for ways to reduce costs and improve quality on threading jobs? These CRI-DAN B setups for multiple-start threading to close tolerances may provide new answers. They cut threading time in half on two complex parts for Bell and Howell, Chicago.

The workpiece: a front cell lens with mating zoom operation sleeve for Bell and Howell 8 mm. Zoomatic movie cameras. Both require a 2-start, .0625-pitch, .125″-lead, Class 4 thread. In addition to a 32 micro-inch RMS finish, the lens diameter and the sleeve bore are held within ±.001″ to assure smooth operation.

The illustrations and captions show how simple, low-cost attachments are used with the fast CRI-DAN automatic threading cycle to combine operations for greater accuracy and increased production efficiency.



Zoom operating sleeve. Material, aluminum—with machined relief at back of bore. I.D. pilot diameter is finish-bored. Boring bar is indexed to the threading tool. A 2-start, .0625-pitch, .125″-lead, Class 4 16 NS thread in the 1.610″ center section is produced in 12 automatic passes at 675 s.f.m. Threading time, 20 seconds.



Front cell lens. Material, aluminum. O.D. pilot diameter is turned. Single tool on front threading slide produces 2-start, .0625-pitch, .125″-lead, Class 4 16 NS thread on the 1.610″ leading diameter in 12 automatic passes at 675 s.f.m. Threading time, 20 seconds.

Using inexpensive carbide tools, the CRI-DAN method is many times faster than thread grinding or thread milling...handles toughest jobs on hardest materials for less.

For complete information on CRI-DAN, circle No. 709 on Reader Service Card

HERE'S ONE WAY TO REDUCE HANDLING AND SPEED CHUCKING OF HEAVY PARTS

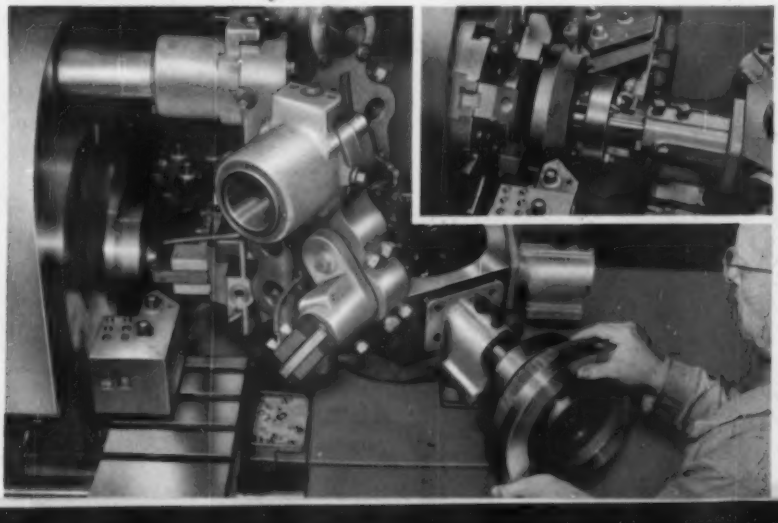
Turret-mounted loading arbor operates during automatic cycle on 2F Fastermatic

Whenever you're handling heavy or unwieldy work, a little extra attention to loading equipment can pay important dividends. For example, this job: The workpiece, a steel bomb base plug forging, is machined in two operations on two Gisholt MASTER-LINE 2F Fastermatic Automatic Chucking Turret Lathes. One operator handles both machines. The second operation setup is shown. It illustrates how most of the work-handling is done *during* the automatic cycle.

Hex turret tools turn the O.D. and chamfer. Operating separately, rear cross-slide tools rough-face the flange and plug base, and front cross-slide tools finish-face the flange, relieve the flange base, and chamfer. A turret-facing attachment on the rear cross slide actuates a turret-mounted slide tool, finish-facing the plug base.

While the slide tool finish-faces, the operator places a new part on the turret-mounted loading arbor. The cycle ends with the rough part facing the spindle. The operator removes the finished piece and starts the new cycle. The hex turret brings the work to the chuck. Spring-loaded jacks force it against the chuck while it is gripped on the O.D. The hex turret reverse-traverses as the spindle rotates and indexes to the first machining station. Time, 7.2 min. f.t.f.

Tooling for second operation on bomb base plug. Turret-facing attachment on rear cross slide actuates turret-mounted slide tool, finish-facing the plug base. At the same time, the operator places a new part on the turret-mounted loading arbor. (Inset) Arbor about to locate work before chucking.



Loading arbor on hex turret operates as part of Fastermatic's automatic cycle—improving chucking accuracy, reducing handling time, increasing production.

For complete information on Fastermatic, circle No. 710 on Reader Service Card.

SUPERFINISHING SAVES TIME, ELIMINATES GRINDING ON PUMP SEAL FACE

Fixture on specially tooled Model 51 Superfinisher handles different part sizes

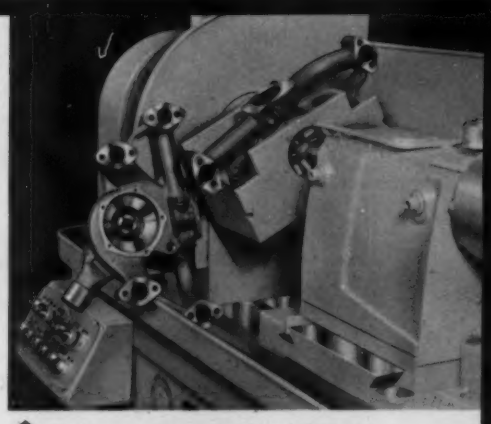
Here is a setup that cut finishing time 50% and eliminated grinding on the pump seal faces of cast iron water pump bodies for a well-known automotive manufacturer. This is a special job, demonstrating the versatility offered by the standard Gisholt Model 51 Superfinisher.

The machine consists of a standard bed with a special box-type fixture mounted on the spindle for centralizing, locating, holding and driving. The fixture is designed to handle more than nine different part styles. A self-driven rotary quill, carrying a cup stone, is also mounted on the bed. An air cylinder moves the quill into working position and retracts at cycle end for loading clearance. Guarding, not shown, encloses the headstock fixture and the rotary quill. It is mounted on tracks and moves easily for loading and unloading.

Here is the Superfinishing cycle: Work is placed in the fixture. The spindle and the cup stone rotate in opposite directions, reducing the pump seal face from a precision-machined surface of 100-125 micro-inches RMS to 8 micro-inches RMS. Superfinish stone contact time, only 12 seconds. Production rate, 60 parts per hour at 80% efficiency.

Specially tooled Model 51 Superfinisher handles unwieldy part in minimum time. Superfinishing eliminates intermediate grinding...provides "controlled" surface, free of smear metal, for longer service life.

For complete information on Gisholt Superfinishing, circle No. 711 on Reader Service Card.



Automotive water pump housing, held in special fixture on Model 51 Superfinisher. Seal face reduced from precision-machined surface of 100-125 micro-inches RMS to 8 micro-inches RMS in only 12 seconds stone contact time.

M & H VALVE & FITTINGS CO. COMBINES OPERATIONS, SAVES 40%

Two Gisholt lathes replace three machines, improve accuracy, simplify machining of fixture work

Right now in your shop you may have jobs where special tooling on a standard lathe can reduce complex work to simple routine operations. That was the case at M & H Valve & Fittings Company, Anniston, Alabama.

M & H came to Gisholt for recommendations for improving accuracy and production on tapered wedges and straight-faced flat discs. Three machines were in use. Wedges and discs were faced and grooved on one machine, a bronze ring was rolled-in on the second and faced on the third.

Gisholt suggested two new machines: a 1L and a 2L Saddle Type Turret Lathe which could be set up to complete a wedge or disc side in a single chucking.

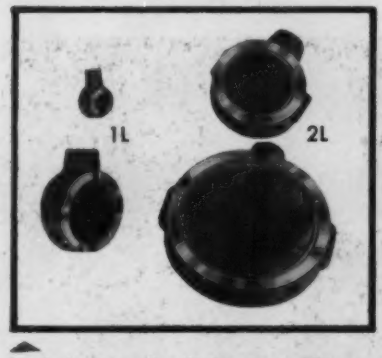
Two important machine features make such a setup possible: 1, machine flexibility combines special machine functions and tooling, and standard machining; 2, a cross-feeding hex turret eliminates need for cross-slide carriage, increasing the swing capacity of each machine.

A chucking fixture assures accurate parallel or angular relationships. Adjustable jacks hold straight work; tapered wedges are held in a special angular locating plate. The wedge is faced and grooved with special cross-feeding tool blocks. The brass ring is rolled-in with rollers mounted on a tool block. Force is applied by a special bed-mounted pusher bar. After rolling-in, the seat ring is finish-machined. One side of a typical 6" tapered wedge is completed in just 9 min., f.t.f.

Change-over is fast, since tooling adjusts to accommodate all work sizes.

Two Gisholts replace three other lathes... eliminate two work handlings...improving accuracy. Time reduction averages 40%. Special tooling does not prevent use of machine for standard work.

For information on Saddle Type Turret Lathes, circle No. 712 on Reader Service Card



Workpiece range handled on two saddle type turret lathes. Seven sizes of tapered wedges and straight discs, from 2" to 6", are machined on the 1L. Four more sizes of each type, from 6" to 12", are machined on the 2L.

Overhead view of rolling-in operation on 12" tapered wedge. Note thrust bar and tool block with rollers which seat brass ring. All tool holders adjust to part sizes.

GISHOLT

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE

SMART SETUP SOLVES PROBLEM . . . CUTS TURNING TIME FOR WESTINGHOUSE

Simple tooling eliminates distortion on stator core assemblies... No. 12 Automatic speeds machining

Largest and smallest of five stack lengths of electric motor stator core assemblies. Cup-shaped tailstock prevents distortion. Simple spacer rings and mandrel bushings speed change-over to different sizes. No. 12 reduces turning time 25%.

You may never encounter a problem similar to this one faced by Westinghouse Electric Corporation, but you'll be interested in the solution. It points out that even the simplest job, on the *right* machine, can present problems that are solved only through experience—the kind of tooling know-how that Gisholt offers on all jobs, large or small.

The operation: Turning the O.D. on electric motor frame stator core assemblies. The machine: A Gisholt No. 12 Automatic Chucking Lathe.

Each core assembly consists of a number of free-cutting electric steel stampings, stacked and laminated. Five different stack lengths in each of two bore sizes are machined at high production rates.

Tooling appears simple. Work is held on an air-operated mandrel—is located against a spacer ring at the headstock end. Spacer rings compensate for different lengths, mandrel bushings for different diameters—keeping change-over at a minimum. A front carriage tool turns the O.D.

Here's the problem: It was found that the laminations at each end tended to "crimp" from tool pressure. Also, gripping in the I.D. caused the laminations at each end to "dish out."

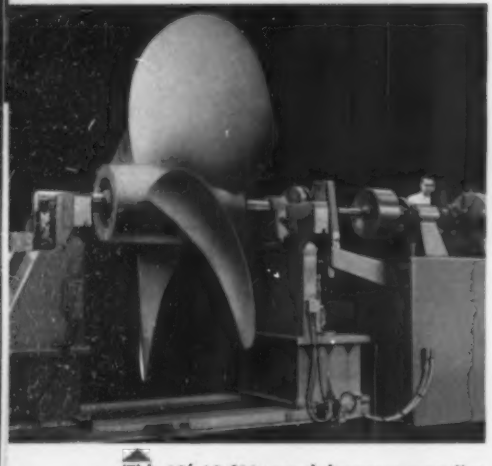
The solution: Maximum-diameter spacer rings eliminate distortion by providing support at the headstock end. A cup-shaped tailstock centering arrangement supports the mandrel and applies pressure evenly around the outer edge of the work.

Smart tooling eliminates work distortion... cuts change-over time on high-production parts. Fast, automatic cycle on No. 12 cuts time 25%.

For complete information on Gisholt No. 12 circle No. 713 on Reader Service Card.

BALANCES SHIP PROPELLER IN 83% LESS TIME

Gisholt Balancer saves 20 hours per propeller for Long Beach Naval Shipyard ... eliminates guesswork



This 12′, 15,650-pound destroyer propeller requires a single-plane, static unbalance correction—the method used when the diameter of workpiece is considerably greater than width. Machine is easily set up to measure and locate static unbalance, and check force or moment unbalance—keeping work well within tolerances required to eliminate excessive bearing wear and possible engine damage. Support pedestals adjust to accommodate work. F.t.f. times are reduced from 24 to only four hours average. Extreme accuracy offered by Gisholt Balancing reduces metal removal required to balance—extending propeller service life.

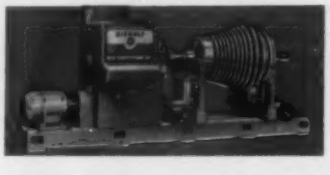
You may not have balancing jobs as large as this 12′-diameter ship propeller, but the balancing principles used here could give you greater speed and greater accuracy in your type of work.

Balancing time on former equipment averaged 24 hours for just one of these 15,650-pounders. In some cases, the job required two men working up to three 8-hour shifts. Considerable guesswork was required to meet the specified tolerances. This meant excessive trial-and-error grinding, with metal removal equaling five years of normal wear on some jobs. And the job was dangerous. Unbalance readings could be taken only at high speeds. There was always the chance that unbalance vibration would throw the huge propeller off the machine.

Now a Gisholt Type U Balancer, with electrical networks providing fast setup and accurate readings, has reduced average time to only four hours, f.t.f. This includes loading by crane, measuring and locating unbalance—correction by grinding, and inspection. Guesswork has been eliminated. Complete safety is assured: The work is held securely in half-bearings and rotational speeds have been reduced to a relatively slow 150 r.p.m.

Gisholt Balancer reduces big propeller job to routine operation with fast setup, accurate amount and angle readings... cuts average f.t.f. time 83%... reduces correction grinding... extends service life.

For complete information on Gisholt Balancers, circle No. 714 on Reader Service Card.



No. 3-460
756

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

Allison-Campbell

ABRASIVE CUTTING KNOW-HOW

ACCO for Better Values

With this Campbell Machine, you can--

Cut 6-inch Diameter Hard Alloys-Cleanly and Accurately-in Less Than 3 Minutes!

• This Campbell wet abrasive cutting machine—the Model 406—will cut tubing, bar stock, angle iron, or any other shape up to 6″ round or square—and it will cut practically *any* material, including the new super alloys and exotic metals. Like all Campbell machines, it's designed to give *accurate* cuts, quickly and cleanly.

HIGH SPEED—4 to 8 seconds per square inch is the normal cutting speed for all Campbell wet abrasive cutting machines. For instance, you can cut 6″ diameter hardened steel in less than 3 minutes.

ACCURACY—Campbell machines are production machine tools. They cut within close tolerances to reduce rejects and scrap loss. For example, the Model 406 will cut 3″ diameter material to lengths within ±.010″, 6″ diameter within ±.030″.

FINE FINISH—Additional finishing operations are rarely required. There is no burn, and burr has been reduced to an absolute minimum.

POWER OSCILLATION—On an oscillating-type machine such as the Model 406, the cutting wheel is moved horizontally back and forth *across* the cut as the wheel is fed downward. The result—greater cutting capacity, with longer wheel life.

PROPER COOLANT APPLICATION—Large reservoir and a 33 gallon/minute pump provide high volume of coolant. Unique Campbell distributor applies coolant equally to both sides of the wheel—an essential requirement for accurate cuts.

OTHER CAMPBELL MACHINES FOR ANY CUT-OFF NEED

Choose from four types of Campbell machines for wet or dry cutting—chop stroke, oscillating, horizontal or rotary—with capacities up to 14″ rounds, 12″ billets, plate up to 6″ thick and 20 ft. long.

Regardless of your application, you'll find that a Campbell machine provides you with the best cut-off method for modern production techniques—far more efficient, accurate and economical for cutting many materials than other cutting equipment.

WRITE FOR DETAILS—Bulletin DH-260 gives the complete story on the Campbell Model 406 abrasive cutting machine. We'll also be glad to send you information on other machines; just tell us your cut-off application. And remember—your Allison-Campbell Field Engineer is an abrasive cutting specialist. Call on him for expert advice.

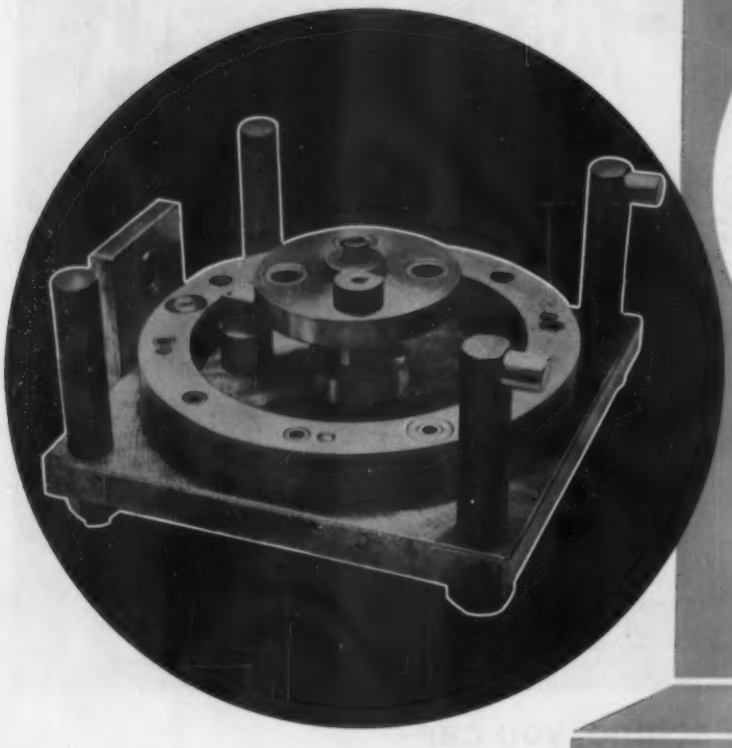
ACCO

CAMPBELL ABRASIVE CUTTING MACHINES

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

THIS DRILL JIG NOW MADE IN 25 FEWER HOURS



LO-AIR

*Low Temperature — Air Hardening**

TOOL and DIE STEEL

Reduces Grinding and Machining Time

LO-AIR, the tool and die steel that features easy machinability and least distortion in hardening, permitted up-grading of steel in this case—as reported by Mr. Joseph Carrera, Plant Superintendent of Quality Tool and Die Company, Hoboken, N.J.—because savings in time more than made up for the difference in material cost.

The drill jig illustrated above required much less heat treating expense—and 25 hours less jig boring and jig grinding time with LO-AIR. It was formerly made of cold rolled machinery steel, which had to be carburized to provide necessary wear resistance. Also, there was a great hazard of cracking in quenching this part. LO-AIR also solved these problems.

For complete data on this and other LO-AIR applications, write for Performance Report No. 23. Also, we will gladly send you a copy of our 12-page LO-AIR brochure which contains full information on this time and money saving tool and die steel. Complete stocks available. Call our nearest warehouse or sales office for quick delivery.

**U.S. Pat. No. 2,355,224*

UNIVERSAL CYCLOPS

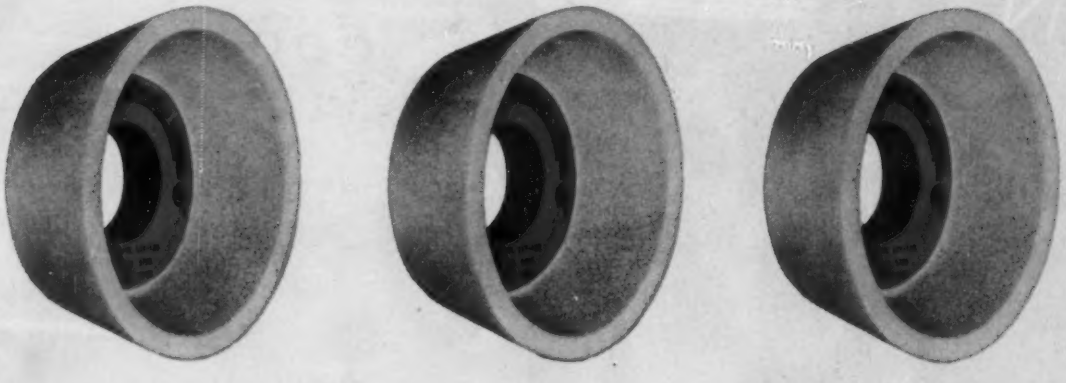
UC STEEL

STEEL CORPORATION

EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

POSITIVE DUPLICATION – EVERY TIME!



You can depend on a rubber stamp to print identical information time after time after time. You can also depend on the Positive Duplication of these toolroom cup (PD)* wheels—and all CINCINNATI (PD) GRINDING WHEELS.

HERE'S HOW (PD) IS ACHIEVED

To supply you with wheels of uniform excellence, Cincinnati's unique (PD) manufacturing process is unvaryingly regulated by 36 separate quality controls. For example . . . Humidity and temperature of the Wheel Mold Room are kept at the same levels every day throughout the year—an essential safeguard of (PD) uniformity.

RESULT: DEPENDABLE PERFORMANCE

Each (PD) reorder wheel gives you exactly the same good job as the original. Production goes up and stays up. Costs go down and stay down. This is the promise and performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your grinding problems with the help of Cincinnati's factory-trained specialists. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI (PD) GRINDING WHEEL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI®
GRINDING WHEELS

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

*Cincinnati Hydrashift Lathes are built in 10", 12½", 15" and 18" swing sizes, and a variety of bed lengths. 15" and 18" sizes may be equipped with Cincinnati HYDRAGUIDE tracers for even greater productivity.

Ask your Cincinnati Lathe and Tool Dealer about this exciting new development from CINCINNATI, or write to us direct.

from cincinnati lathe and tool

CINCINNATI HYDRASHIFT*

The first economy-priced geared head lathe with
POWER DIAL SPEED SHIFTING

HYDRAULIC POWER SUPPLIES THE MUSCLE ON NEW CINCINNATI HYDRASHIFT LATHES

Standard equipment on the new Cincinnati lathes includes HYDRASHIFT, the easiest and fastest method for spindle speed shifting on a geared head lathe. To change spindle speeds, the operator has only to dial the desired RPM . . . *hydraulic power supplies the muscle for the shift.*

New Cincinnati Hydrashift lathes are designed to provide more time for cutting and to reduce operator fatigue to a minimum. Yet, with their many new operating features, *they are still in the economy price class.*

new . . . FROM HEADSTOCK TO TAILSTOCK

new High Speeds with All-Geared Headstock—husky Hydrashift gearing provides 12 speeds in geometric progression up to 3000 RPM.

new Compound and Cross Slide—wider, stronger for heavy, high speed cuts; large, easy-read dials for greater accuracies with more operator speed and convenience.

new Quick-Clamping Tailstock—Cincinnati's unique tailstock design is even more versatile for fast tailstock positioning.

plus—NEW greater horsepower . . . NEW husky beds with "Hardened" flame-hardened ways . . . NEW coded pushbutton controls . . . NEW chip pan (slides in and out for convenient cleaning) . . . Totally enclosed quick-change feed box with 48 threads and feeds . . . and many other exclusive features on the

NEW CINCINNATI HYDRASHIFT LATHES

cincinnati lathe and tool co.
3207 Disney Street, Cincinnati 9, Ohio
"HYDRASHIFT" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

CIRCLE 207 READER SERVICE CARD CIRCLE 208 READER SERVICE CARD

PRECISION Quarterly NUMBER 4

PRECISION WELDER AND FLEXOPRESS CORPORATION, 3520 Ibsen, Cincinnati 9, Ohio

For this magnificent automobile, these aluminum stampings mean . . .

Grille Parts TEN TIMES FASTER

DETROIT — How much would you pay for a 900 per cent boost in production efficiency? The builder of one of America's most fashionable automobiles decided it was well worth the price of a new Precision Flexopress.

The automaker had been punching out grille parts on standard sheet-fed presses. The fins are made of .120" aluminum. They have to interlock, egg-crate fashion, and look flawless in the finished product. But even for flawless decoration, the production rate of only 1000 fins an hour was exasperatingly slow.

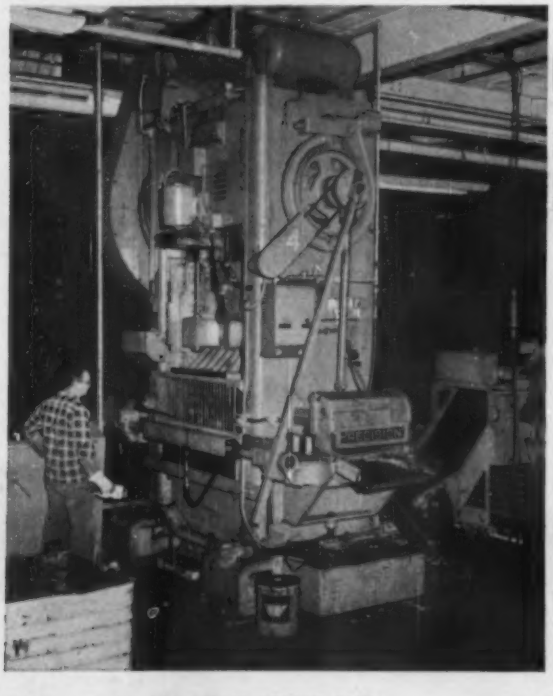
That was before the new Flexopress was installed. Now this same automaker turns out 1000 fins in seven minutes, which is a very fortunate situation because his cars are selling fast.

The Flexopress came equipped with unreeling and flattening equipment for handling up to 22" wide coils. Otherwise, it is a standard, heavy-pattern, 200-ton Flexopress with 6" stroke, complete with built-in coil feed, and designed for general purpose blanking, forming, and light drawing.

It got so far ahead on grille fin production that Planning started pulling jobs off slower presses and putting them on the Flexopress. One was an 11½" long hood retainer spring which the Flexopress proceeded to blank and punch from wide steel strip at a rate of 120 per minute, and with the die off center, too.

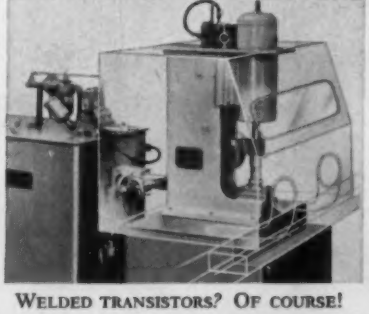
People who know presses know the reasons: The Flexopress is the only press constructed with pre-loaded, ball bearing slides. With no sliding ways to heat up, there's no thermal misalignment and no lubrication problem. The ram can't oscillate — it moves in one plane only and holds its alignment. That means longer die life and accuracy that doesn't depend on leader pins and bushings. So it's no idle boast that at 150 strokes a minute, this 200-ton press with 6" stroke can really hold its bottom-of-ram-to-bed accuracy of .0005" or less per foot of bed length.

The reputation of a press is based on the job it does — and Flexopress is winning bouquets for its work at this automotive sheet metal plant.



PRECISION Flexopress made a 900 per cent boost in grille production possible.

NO WELD TOO CRITICAL

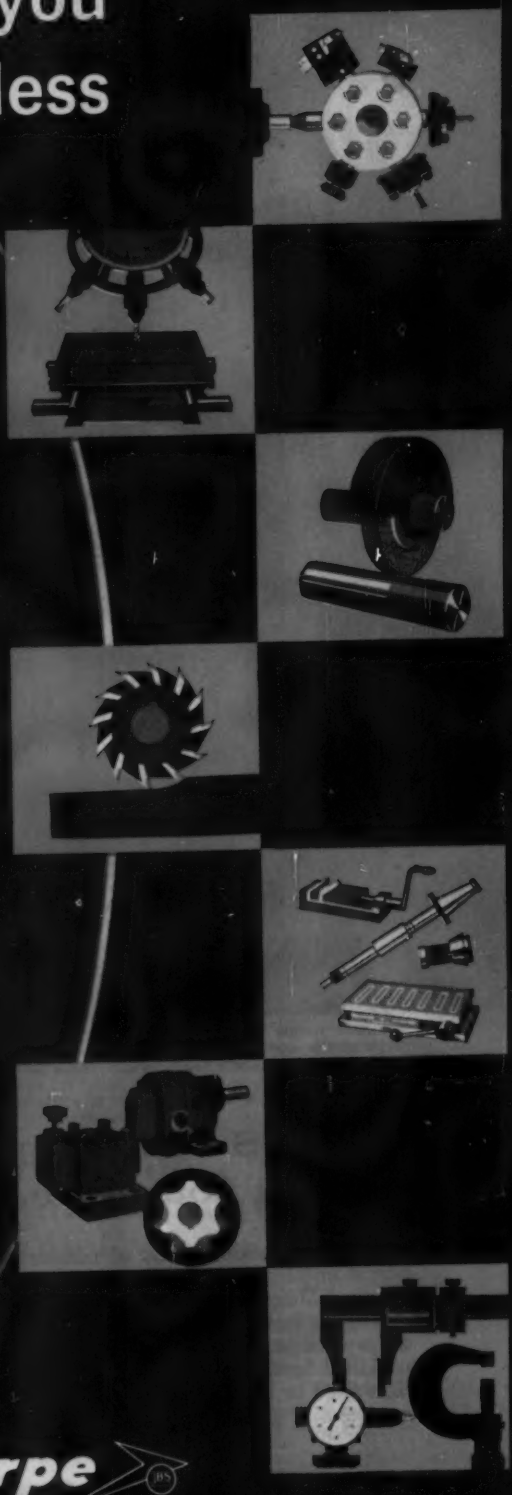


WELDED TRANSISTORS? OF COURSE!

Here's a new line of Precision Magnetic Force Welding Gun machines developed for making ring welds to seal transistor "cans." Clean-cut design makes it easy to enclose these guns in dry boxes for controlled atmosphere welding. Magnetic force, which applies pressure at the critical moment of maximum heat, assures a 98 per cent or better yield of gas tight welds on transistors big as a walnut or small as a grain of rice.

Remember, when you want to make critical welds, Precision has the experience to help you do the job right.

to help you
make more for less



Brown & Sharpe
PRECISION CENTER

TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER...

With one simple motion, B&S Dial Snap and Bore Gages slide onto (or into) the work. No adjusting and little "feel" is required, to get accurate ten-thousandth readings with these self-centralizing, spring-loaded tools. They spot exact work conditions, such as bell-mouth, out-of-roundness, etc. And by showing how much work is "under" or "over" — they save "borderline" pieces — aid setting of cutting tools.

B & S Dial Snap and Bore Gages tell you faster ...tell you more...in measuring production parts

For precise measurements of outside dimensions and bore diameters — on a *production* basis — you can't beat Brown & Sharpe Dial Snap and Bore Gages!

They're faster than micrometer or vernier tools for a series of repetitive measurements — more accurate in unskilled hands. And they "tell more" about the work than fixed or comparator gages because they are *direct reading* over a complete *range*.

Four B&S Dial Snap Gages cover a range of 0" to 4" by ten-thousandths. Seven B&S Dial Bore Gages cover a range of ⅛" to 13" by ten-thousandths, with a minimum of interchangeable gaging heads and extensions. Ask your nearby industrial distributor to show you these economical, time-saving tools for precision production measurements. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

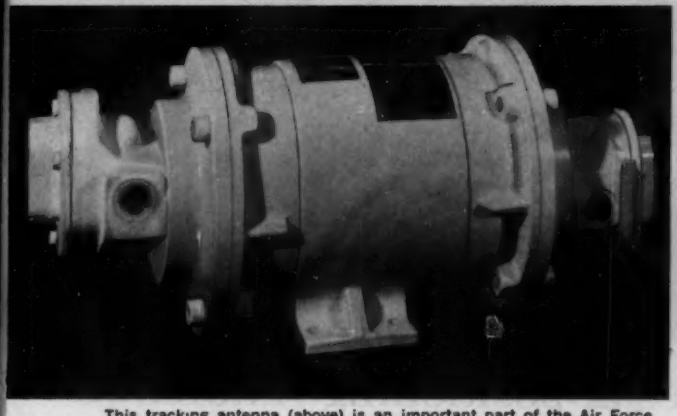
Be sure to see us at Booth 1131, ASTE Tool Show, Detroit, April 21-28

Brown & Sharpe PRECISION CENTER

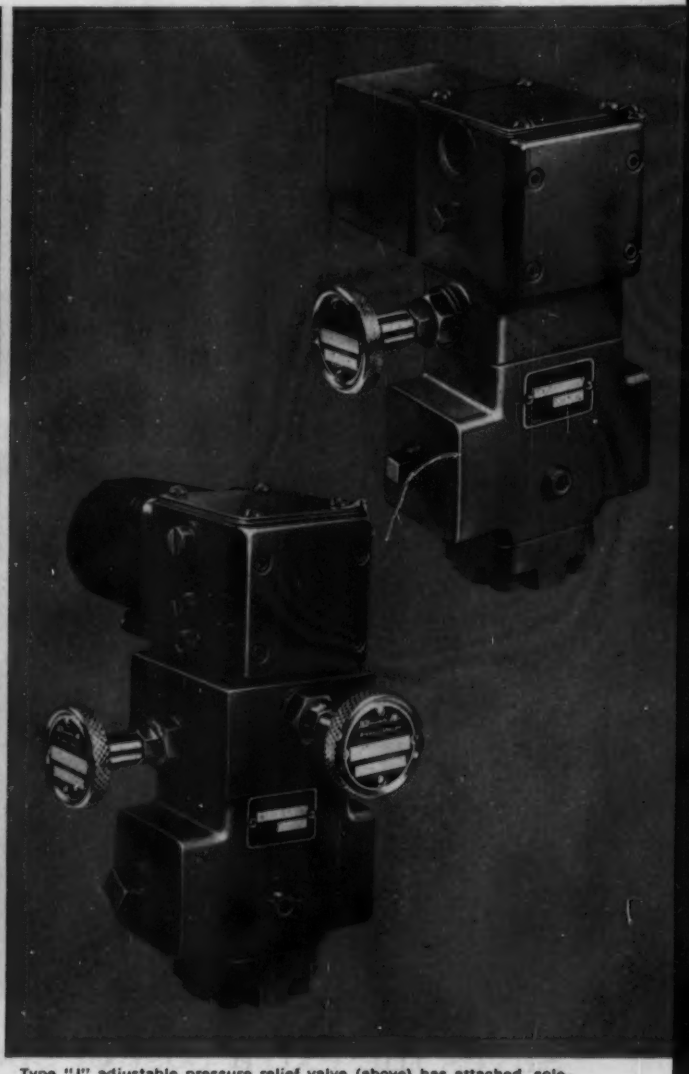
◄ CIRCLE 210 READER SERVICE CARD

CIRCLE 211 READER SERVICE CARD

TO HELP YOU HANDLE FLUIDS
MORE EFFICIENTLY...AND FOR LESS



This tracking antenna (above) is an important part of the Air Force Ballistic Missile Early Warning System. Goodyear Aircraft Corp. developed it for R. C. A., prime contractor on the system. B&S pumps replenish oil in drive system; control position of drive pump yoke; lubricate entire system.



Type "J" adjustable pressure relief valve (above) has attached, solenoid-controlled pilot valve — provides automatic, full bypass of fluid at idling pressure. Type "D" dual pressure relief valve with solenoid control (below) — provides automatic choice of two, individually-adjustable maximum pressure settings.

Goodyear designers lubricate BMEWS antenna with B&S Pumps

Designers of this antenna's drive unit needed 4 pairs of pumps, mounted on double-ended motors.

B&S pumps were chosen for their self-priming ability from minus 65°F to plus 160°F; ruggedness and long life.

These and other advantages of Brown & Sharpe gear, vane and centrifugal pumps are clearly described in our new Pump Catalog 36P.

Send for your copy today! Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Double A develops first multi-purpose relief valves

Here are two more Double A "firsts" in compact valve units: Adjustable relief valves with *solenoid controls*.

Already successful in machine tools; foundry, steel-mill, mining, material handling and stretch-forming equipment — they can help *you* simplify your hydraulic circuits, too.

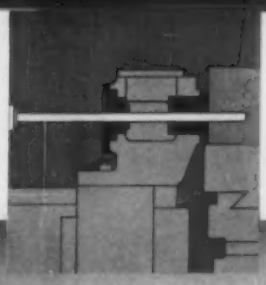
For details on these and the complete line of Double A hydraulic control valves, power units, Gerotor pumps — write: Double A Products Co., subsidiary of Brown & Sharpe Mfg. Co., Manchester, Michigan.

Be sure to see us at Booth 1131, ASTE Tool Show, Detroit, April 21-28

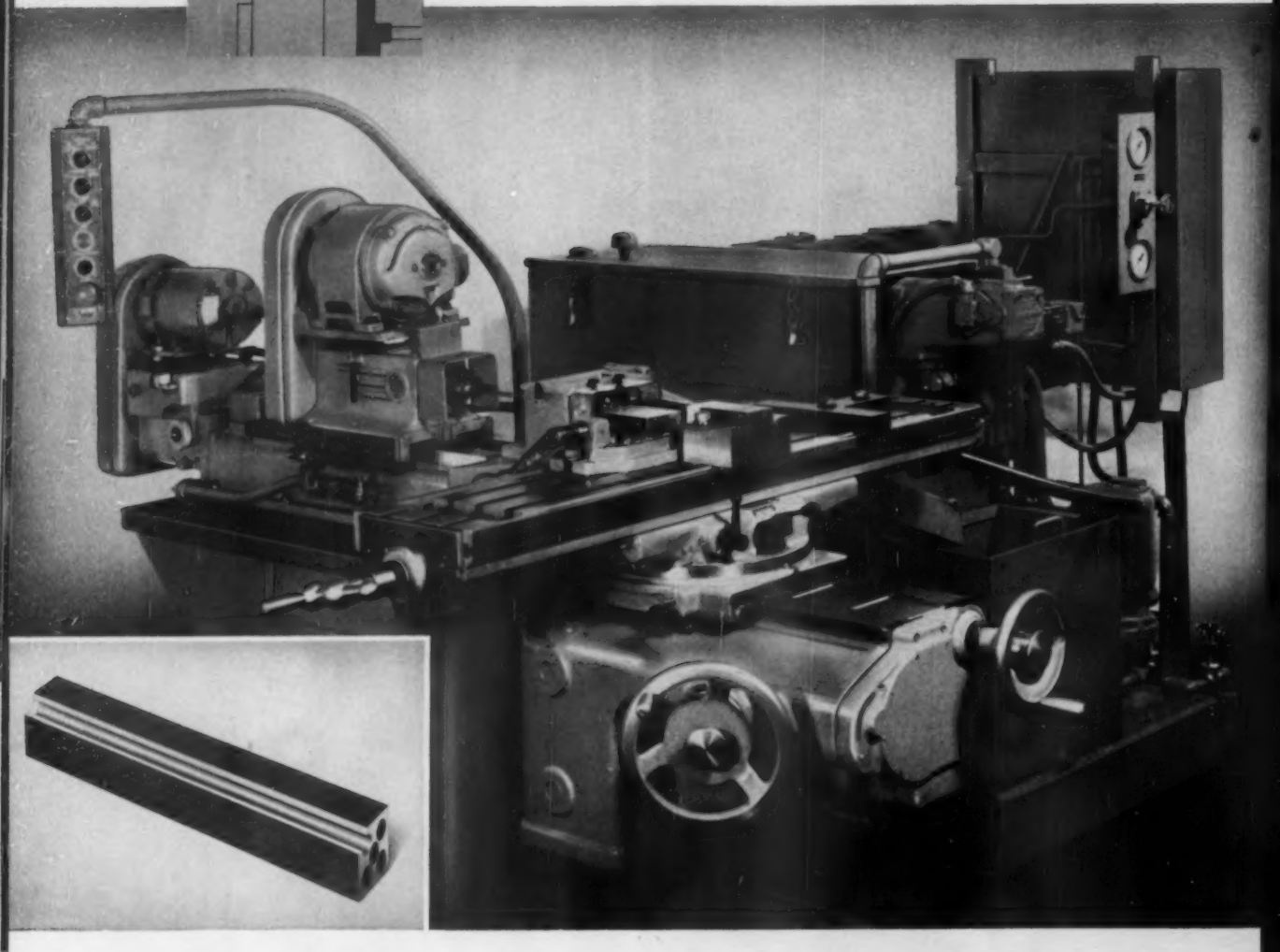
Brown & Sharpe PRECISION CENTER

CIRCLE 212 READER SERVICE CARD

MMT-PE



TO HELP YOU REDUCE
DEEP HOLE DRILLING COSTS



Saves the extra cost of special positioning fixtures - the new Brown & Sharpe Deep Hole Drilling Machine

Simplified set-ups, tooling economy, and exceptional job adaptability are basic advantages of this new, revolving drill type machine, along with many other features unavailable in conventional equipment used for "gun drilling."

The machine itself provides all directional adjustments needed for fast, accurate positioning of the work piece. Standard vises or other simple clamping devices serve to hold the work for most jobs. You avoid the expense of special, complex positioning fixtures for multiple hole location.

The chip box secured to the column of the machine supports the front drill bushing in accurate alignment with the axis of the drill spindle, maintaining hole surface finish in the low micro-inch range. Positioning controls with the same built-in precision as in Brown & Sharpe Milling Machines assure accurate center location and hole alignment.

Drilling-head speeds from 2500 to 10,000 rpm, are available as specified. The machine takes drills from ⅛″ to 1″ dia., and provides up to 12″ feed stroke (24″ with optional, extra equipment). The high pressure coolant unit (in background) will provide up to 30 gpm of oil and pressures up to 3000 psi.

Find out how the B&S Deep Hole Drilling machine can be adapted to your needs — with special arrangements, when required, such as optical positioning and tape control. For complete information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER

CIRCLE 213 READER SERVICE CARD

MMT-PE

TO HELP YOU GRIND MORE FOR LESS

Up to 300% faster form grinding in carbide, ceramics – Brown & Sharpe MICROMASTER with VISUAL GRIND

VISUAL GRIND, the built-in comparator on the B&S 618 Surface Grinding Machine, permits tool and die makers to meet today's demand for intricate shapes in super-hard materials with spectacular savings in work hours and wheel costs.

Skilled operators can save up to 300% in set-up and grinding time. There is no need to remove work for frequent inspection with separate equipment. Semi-skilled workers, also, quickly learn to "follow the line," and match the clearly visible, true image of the work to the form layout drawn on the screen. Wheel costs are drastically reduced in grinding carbide and ceramics — any contours can be reproduced with a few simple wheels.

An unlimited variety of forms can be produced in punches, dies, and similar work — with through, blind, or template grinding — using standard equipment and simple attachments.

The MICROMASTER® with Visual Grind provides all the extra profit-saving advantages of the new B&S 618 Surface Grinder. It can be readily used for other grinding, of surfaces up to 6" x 14", without disturbing the optical system.

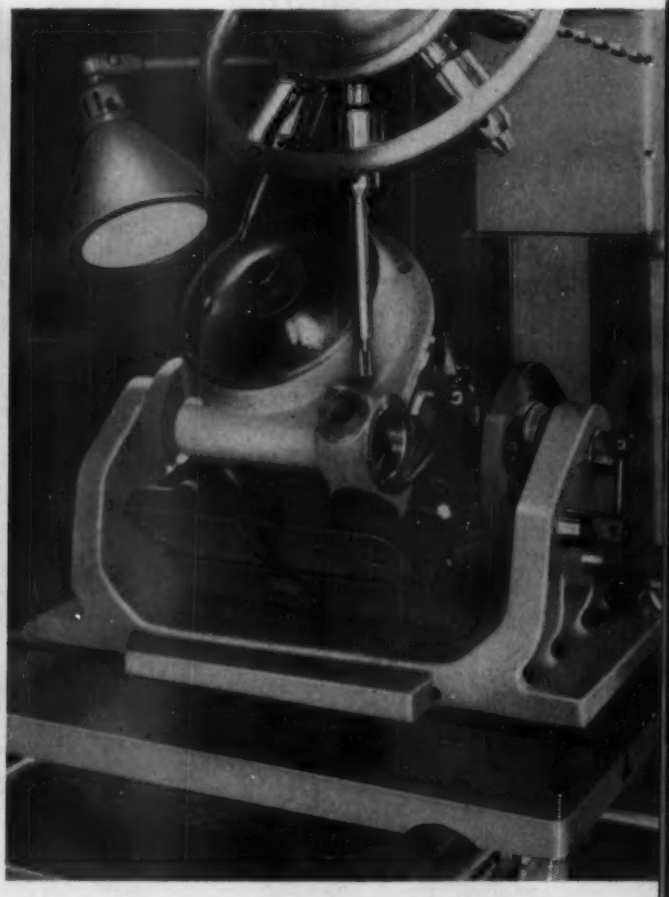
THE VISUAL GRIND® system is manufactured by The Cleveland Grinding Machine Co. and is sold only by Brown & Sharpe. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER

CIRCLE 214 READER SERVICE CARD

MMT-PE

TURRET DRILLING MACHINES TO HELP YOU DRILL MORE FOR LESS



Large parts machined 300% faster with simple tooling on Brown & Sharpe Turret Drilling Machines

For large as well as small parts, the B&S Turret Drilling technique drastically reduces production drilling costs.

The typical machine casting shown requires machining of 23 holes spaced from ½" to 12" apart — drilling, tapping, and counterboring in 4 planes. With simple B&S designed fixtures, mounted on a 10½" x 12" B&S Positioning Table, accurate hole location (within .001") takes only a few seconds in each sequence. Production time is one-third that required for conventional drilling.

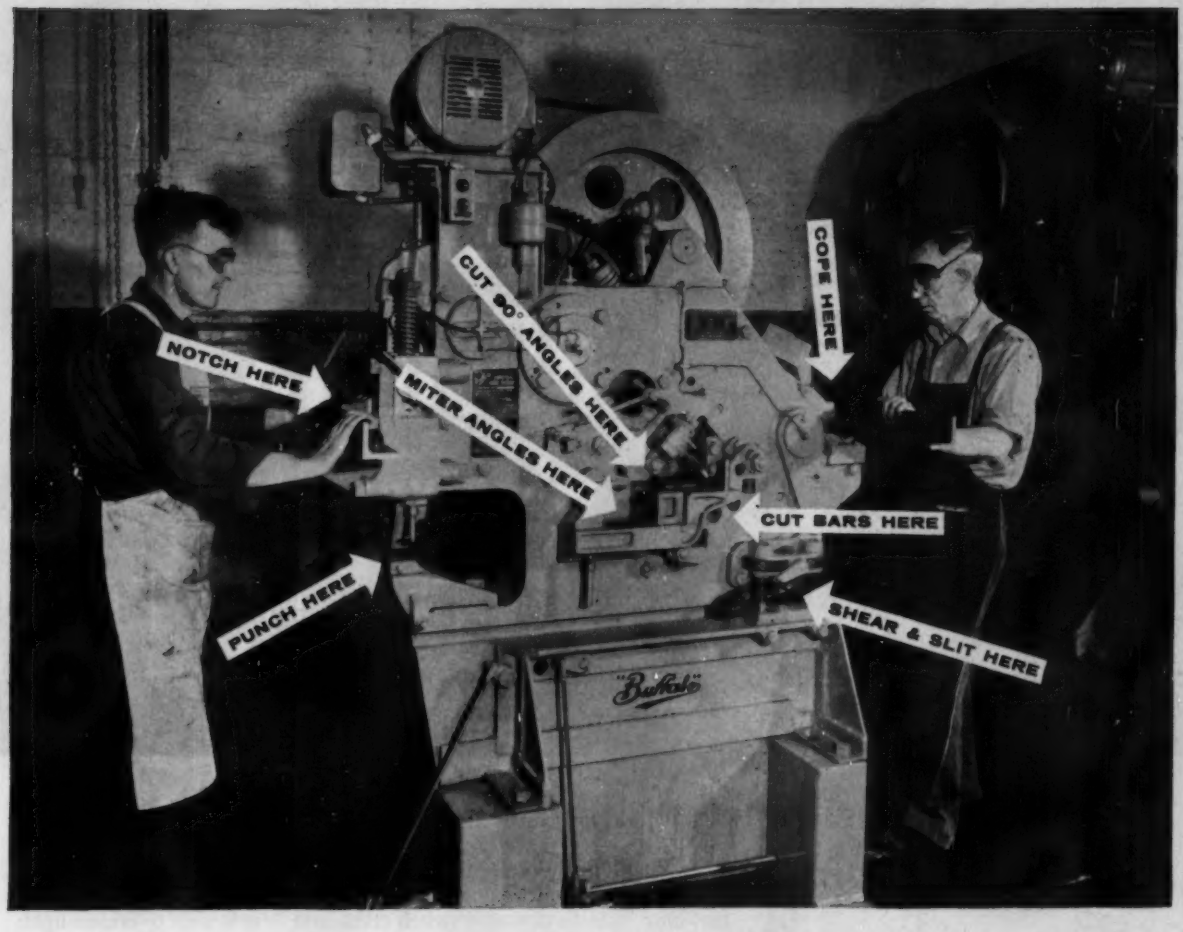
Rapid, accurate positioning methods can be similarly adapted for big savings in production drilling of your larger pieces. On the Model A Turret Drilling Machine shown, you can machine any hole pattern within a 24" circle.

Brown & Sharpe Turret Drilling can save up to 80% of your costs for conventional gang-drill, box jig methods. It permits multiple operations at a single station — accurate duplication of any hole pattern without expensive jigs. You save in work transfer and set-up time, in tool wear and maintenance, in capital investment and floor space.

The BROWN & SHARPE Tooling Clinic designed the fixtures shown above to take full advantage of turret drilling economy. The work is held as shown (left) in a simple clamping fixture for the first sequence, 24 operations in 8 holes. It is then turned over in the same fixture for 23 operations in 8 holes. The trunnion with index head (right) orients the work for the final sequence, 20 operations in 7 holes, in 3 planes. Send your parts and drawings for a free estimate of savings with turret drilling. Write: Turret Drilling Division, Brown & Sharpe Mfg. Co., Providence, Rhode Island.

Brown & Sharpe PRECISION CENTER

CIRCLE 215 READER SERVICE CARD



SEVEN OPERATIONS—SAME MACHINE

SAVES ON MAINTENANCE AND PRODUCTION

A BUFFALO Iron Worker can be the most useful, productive and cost-saving machine in your shop.

Without changing tools, it will do a variety of jobs — **several at the same time.**

It's compact, ruggedly-built, requires practically no maintenance and is available in your choice of sizes and models.

Worth investigating, a BUFFALO U. I. W. pays its own way and returns dividends. Maybe you can't afford to be without one. Write for Bulletin 322 or . . . better still . . . call in your nearest BUFFALO representative.

BUFFALO FORGE COMPANY

509 Broadway • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

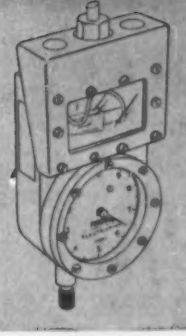
You're better off with Buffalo Machine Tools to Drill, Punch, Shear or Bend.

Lights show size category. Actual work size is shown on the dial.

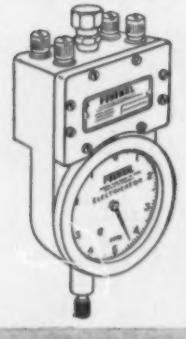
faster gaging . . .

ELECTRIFYING RESULTS . . .

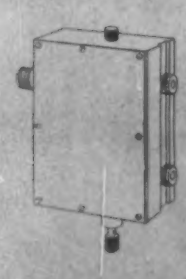
when you use the ELECTRICATOR



WETPROOF STYLE
(For each regular model)



DOUBLE UNIT MODELS
(Four limits, five categories)



ECCENTRICATOR
(For indicating eccentricity, runout, squareness)

There's nothing quite like the Federal Electricator — so easy to apply — so economical — so accurate . . . a Miracle Movement Dial Indicator and two-limit, spindle-actuated switch combined. Use it with tolerance lights in place of your dial indicator for faster, more accurate bench gaging. Use it together with a signal unit for fully automatic inspection or automatic machine or process control.

The Electricator is a high precision unit — switching accuracy is better than 50 millionths on all models. Voltage across the switch is extremely low and switching current is in the order of one milliampere. Therefore, arcing and pitting of contacts is eliminated and accuracy is reliably maintained. The Electricator is calibrated, so it requires only one master.

All Electricator models incorporate the new Federal Miracle Movement which is so wear-resistant . . . so shock resistant . . . you will probably never have to repair or replace it. Six regular models are immediately available from stock. Four different graduations — .0001", .00025", .0005", .001". Prices from $75.

The switching portion of the Electricator is available as a separate unit to operate tolerance lights and/or provide control limits without indicating actual size.

The Federal Eccentricator, a similar type of high precision unit, indicates eccentricity, runout, squareness, etc., *without* being influenced by normal piece-to-piece variations in size.

For more information, write . . .

FEDERAL PRODUCTS CORP.
6123 Eddy Street, Providence 1, R. I.

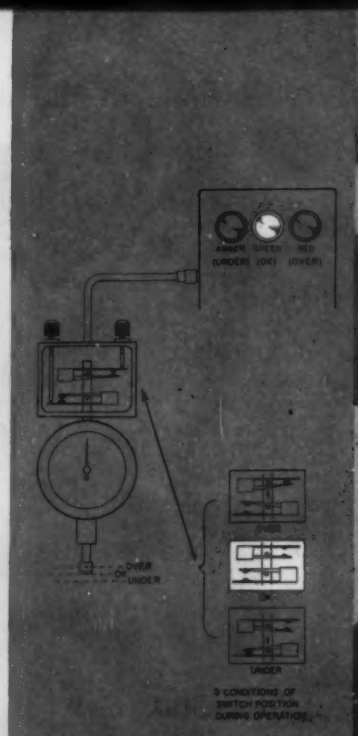
Ask **FEDERAL** *First*

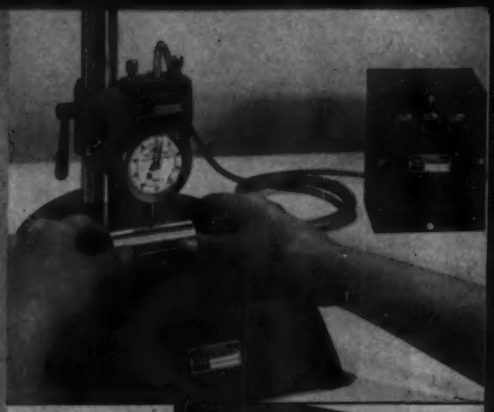
FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging
CIRCLE 217 READER SERVICE CARD

FOR HIGH SPEED BENCH GAGING
(Single or Multiple Dimensions)

It's easy to install the Electricator in place of the dial indicator on your present comparator when you need greater speed. The Electricator eliminates having to make borderline decisions so you get more reliable results . . . and faster results . . . using less skilled help, and with less operator fatigue. Many concerns have up-graded their manual gaging this economical way with great success.

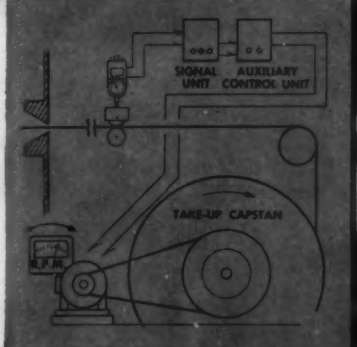
The Electricator offers the most economical way to make multi-dimension checks rapidly and reliably. The signal lights on its control panel instantly show the operator whether the piece is within tolerance or not. No need for operator to look at a group of indicators one by one in order to determine acceptability.





CONTINUOUS PROCESS CONTROL

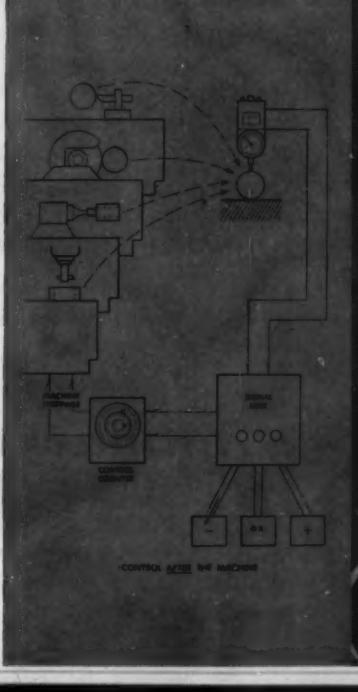
Because the Electricator is compact, it can be installed easily on most continuous processes to indicate size trend accurately so correction can be made *before* scrap is produced. In many cases, Electricator, working into appropriate signal unit, can be used to *control* size so process automatically produces within tolerance.



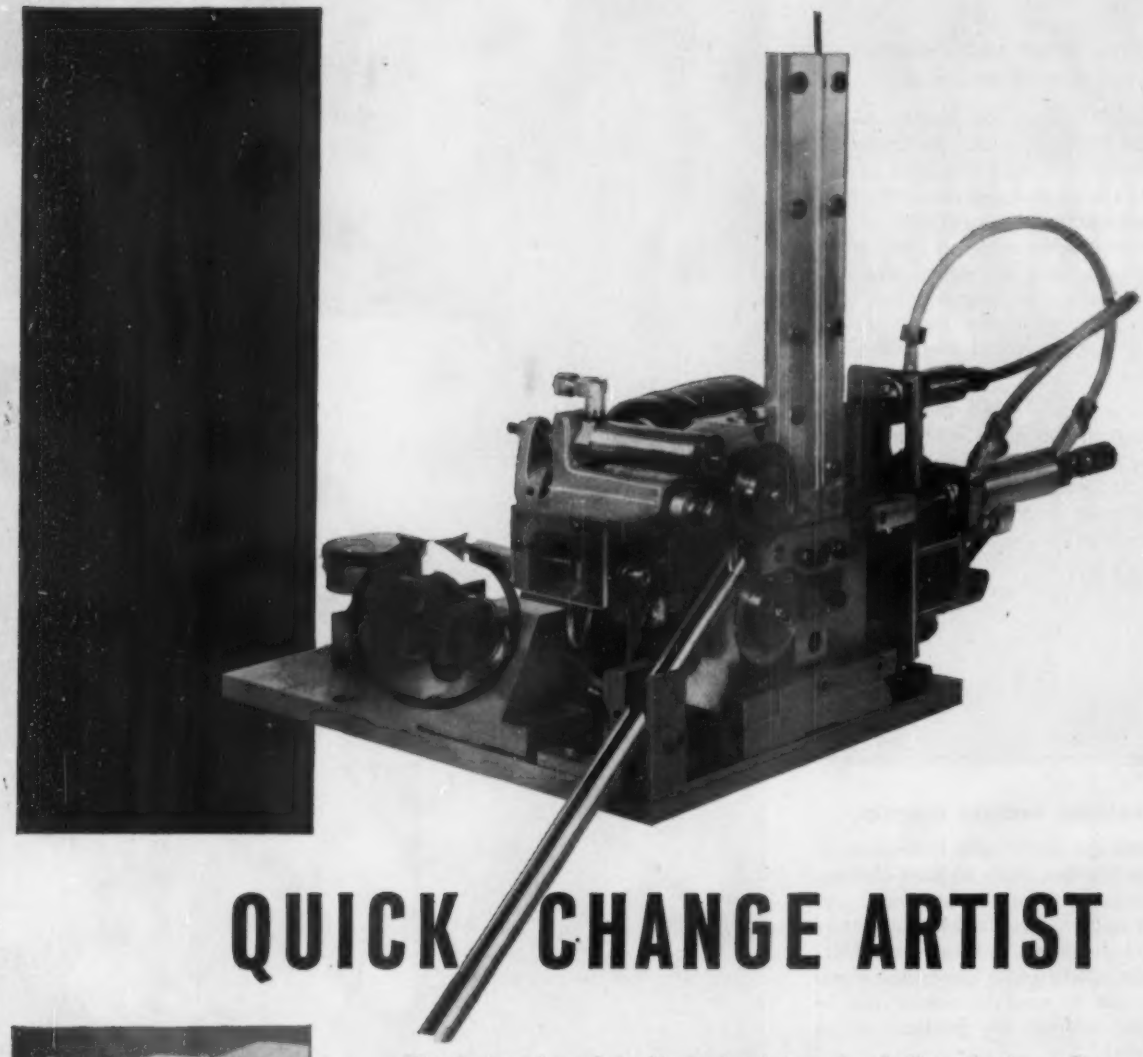
HIGH SPEED AUTOMATIC MULTI-DIMENSION INSPECTION AND MACHINE CONTROL

Electricators have rapid response — can gage and sort up to 6,000 pieces per hour, providing up to 5 sorting categories. Wide range adjustment of limits to suit tolerances. Use of low switching voltage and current provides high-reliability performance.

Electricator can also provide post-process machine control in addition to high-speed gaging and sorting. Using simple control counter, gage automatically stops machine when tolerance limits are exceeded.



CIRCLE 218 READER SERVICE CARD



QUICK CHANGE ARTIST

Here's "packaged tooling" for internal grinding that's really versatile. With the turn of a single knob, fixtures can be interchanged to permit rapid set-up away from the machine. Production continues with hardly an interruption.

Quick change "packaged tooling" is only one of the many exclusive features of the Bryant Model "B" Centalign® — features which are helping manufacturers of miniature components establish new records for accuracy and production.

If you are grinding the bores or raceways in miniature bearings or similar parts, investigate the Bryant Model "B" Miniature Centalign. It will repay you in increased profits.

P.S. Space is no problem with the Bryant Miniature Centalign. It packs all its job-engineered features in only 8¼ square feet.

BRYANT Chucking Grinder Co.

85 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Springfield, N. J. • Cleveland • Detroit • Indianapolis • Chicago • Los Angeles

Internal Grinders • Special Machinery

Soft Rubber Boots Prevent Injury to men or machines. A-B pendant stations are available with from 2 to 16 units, plus emergency stop unit in bottom of enclosure.

Allen-Bradley offers the

MOST COMPLETE LINE

of oiltight heavy-duty

CONTROL UNITS

The wide selection of Allen-Bradley Bulletin 800T push buttons and control units will enable you to satisfy each and every control station requirement. A-B control units and stations have seals to exclude oils and cutting fluids—contacts cannot become fouled. And *all* control units have the popular A-B double break, silver contacts that assure reliable operation—without maintenance. The rugged construction, flexibility, and generous wiring room of Allen-Bradley's Bulletin 800T line are "bonus" features. To get the best in every way—insist on Allen-Bradley. Send for Publication 6090, today.

ILLUMINATED PUSH BUTTON
Space-saving two-in-one control unit.

4-WAY SELECTOR SWITCH
Can also be furnished for 2-way operation.

ENCAPSULATED PILOT LIGHT
Transformer type for rugged 6-volt bulb.

PUSH-TO-TEST
Six different color lenses available.

SELECTOR SWITCH
With coin slot operator. Other operators available.

TIME DELAY
Delay adjustable from 0.5 to 5 seconds.

POTENTIOMETER UNIT
Furnished in 2- or 5-watt capacity ratings.

LOCK TYPE
For selector switch or push button operation.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.

16 UNIT STATION
in die-cast aluminum enclosure. Sheet metal cabinets also available for up to 25 control units.

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Yes, Allen-Bradley also makes...

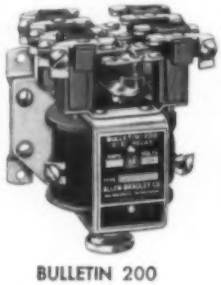
DC Contactors

Here's the only line of DC contactors using the simple solenoid design—with ONE moving part—in all ratings through Size 4. And their double break, silver alloy contacts never need servicing.

BULLETIN 202

DC Control Relays

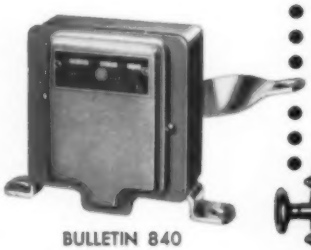
These relays are the counterpart of the Bulletin 700 line of AC relays—of which millions are in service. With only ONE moving part—these relays provide the ultimate in long life and reliability. Like the AC line, they have double break, silver contacts that never need maintenance. Made in a variety of types and with up to 8 switching poles.



BULLETIN 200

Float Switches

This versatile line of float switches is available in a wide range of types and enclosures to handle practically every industrial pumping job. They all feature a snap-action switch mechanism for positive operation no matter how slowly the liquid level changes.

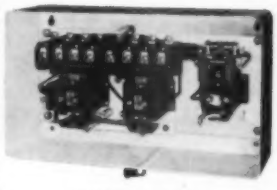


BULLETIN 840

BULLETIN 1209

Loom Switch

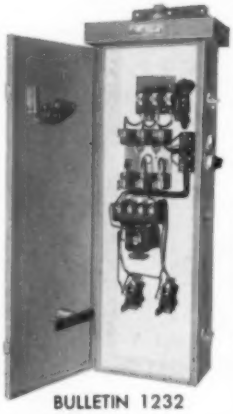
Manual starting switches designed for textile loom service. Design of operating lever makes accidental operation impossible. Lint-tight enclosure eliminates fire hazard.



BULLETIN 1270

Automatic Transfer Switches

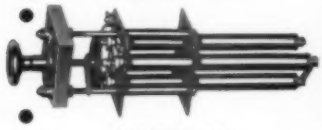
For use where power must be maintained, these panels automatically transfer the load to an auxiliary supply when normal supply fails or falls too low. Transfers automatically when the normal power supply is resumed. Mechanically interlocked.



BULLETIN 1232

Pump Control Panels

Designed for irrigation and oil field pumping applications. Can also be used with outdoor lighting systems. Uses standard A-B Bulletin 709 solenoid starter with manual disconnect switch or circuit breaker in weatherproof enclosure. Available with many optional features.



BULLETIN 410

AC and DC Rheostats

Provide absolutely stepless control over a wide resistance range. Full wattage capacity available at all settings. Sizes to 5400 watts.

4-60-RM

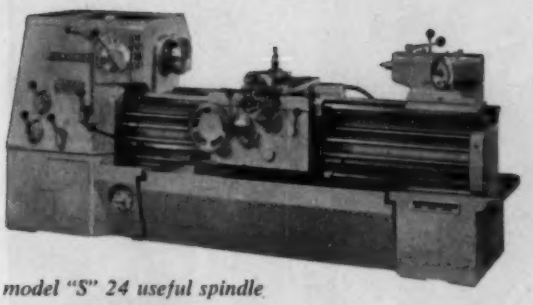
ALLEN-BRADLEY

Member of NEMA

Quality **Motor Control**

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

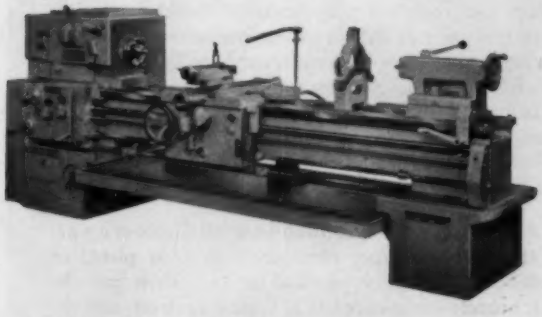
Engine & Toolroom Lathes



model "S" 24 useful spindle speeds, 66 feeds & threads
heavy duty 16"
medium duty 20"

MMT=PE

new developments coming!



model 280 16 useful spindle speeds, 60 feeds & threads
heavy duty 14", 16"
medium duty 20"

Springfield lathes have 10, 15 or 20 horsepower motors for heavy cuts, and have simple, practical features that keep the operator productive and keep the maintenance man away. Pressurized mist lubricates the headstock. Only four gears are in mesh for a given speed—the others run free. Clean, functional design and simplified controls promote pride of workmanship and minimum waste motion.

Ruggedness with precision has always been characteristic of Springfield lathes—because they are built to *one* standard of excellence. A Springfield engine lathe meets the accuracy standards set up for toolroom lathes —without *any* cost penalty.

Whenever you want maximum power and efficiency, and the cost designed out by designing simplicity in, consider a Springfield lathe. A full range of attachments is available—hydraulic contouring and reproducing, plain and universal relieving, taper, etc.

If you would like to know more about Springfield lathes, please write for Bulletins 190-G and 201-G.

The Springfield Machine Tool Company
Springfield, Ohio

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small Gears . . . very small Gears . . . extremely small Gears . . .

PRECISION-MADE IN PRODUCTION QUANTITIES!

We'll take off our hats to nobody when it comes to filling requirements for Gears to 120 DP.—turned out in economical quantity runs—which meet the toughest specifications! Bevels, Helixes, Internals, Clusters—of steel or aluminum—miniaturize as you will, G.S. can design and produce the Gears you need for Instruments—Appliances—Missiles—Control Systems—and the like. Our ability to give spectacularly uniform performance on Gearing of small size or fine pitch has, perhaps, been our best-known specialty during our 43 years of dealing with demanding users (though today we do many other Gear-making jobs with equal facility and skill).

Have *you* an application where precision in small Gears is a vital factor in smooth and satisfactory production in your plant, or trouble-free performance of your product in use? Then put the specially-trained, broadly experienced G.S. Gear Engineers, and the superbly equipped G.S. plant, on your team. Today would be a good time to start!

•

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SEND FOR G.S. *illustrated folder! See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. Folder contains 23 pictures of Small Gears, plant view, Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!*

44 Years of Specializing in Small Gearing!

Heller

"Job Tempered"

Hack Saw Blades

UNIFORMITY PAYS OFF! Uniform set gives the teeth of every Heller blade the clearance needed for straight, fast cutting. Uniform shape, spacing and height of teeth distribute wear evenly and lengthen life. Uniform temper over the full length of every blade adds extra resistance against stresses and strains.

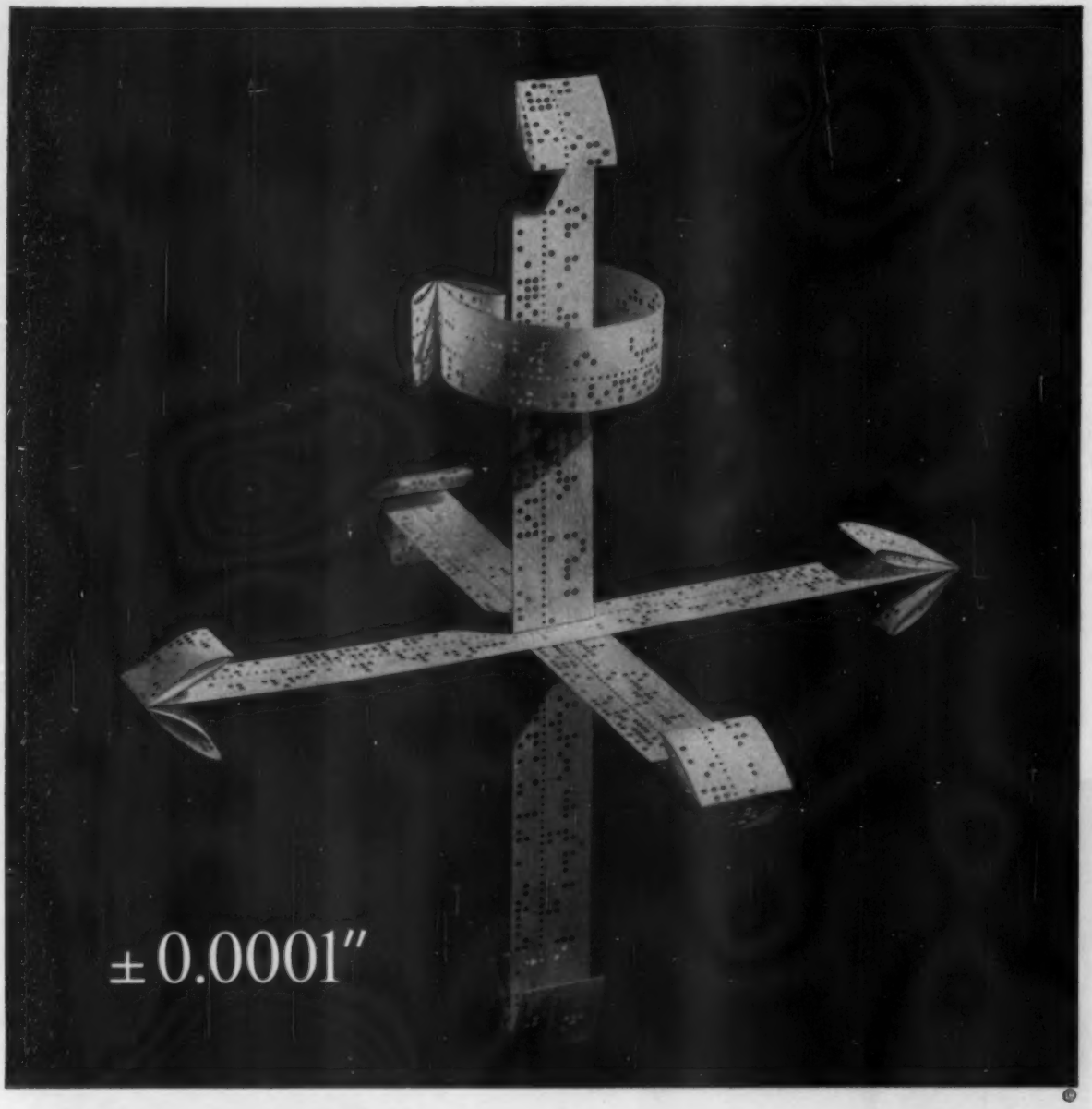
TEST THEM YOURSELF! You'll find that Heller's certified uniformity within each blade and from blade to blade adds up to superior cutting at lower costs. Your nearby Heller distributor has a complete line of Heller Hack Saw Blades . . . 3 types for power use . . . 3 types for hand use . . . in all standard specifications. So, he can help you select the right blade for any job.

Heller for Heller

HELLER TOOL CO.

HELLER TOOL CO. SINCE 1838

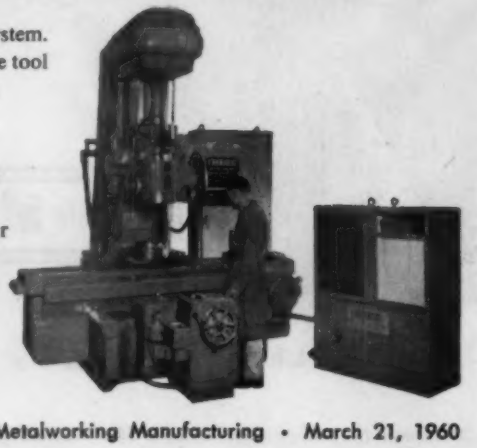
America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.



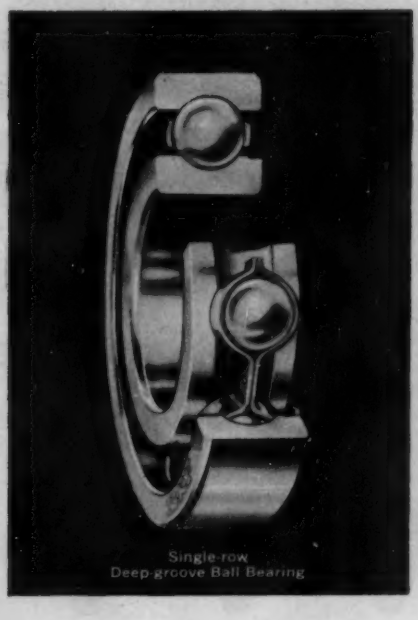
PRECISION BORING: Control gains a Third Dimension!

Now Fosdick adds Numerical Depth Control to its unique positioning system. Another loophole for error in precision boring has disappeared. Watch the tool drive smoothly to depth, boring a hole with finer finish, precise in depth and location. Watch the tool advance and retract quickly, saving time. *Tape or dial any depth. Absolutely no stops to preset.*

See how this control signals every tool change and compensates for tools of random length. It was planned when the Fosmatic precision boring machines were designed, so that it fits and takes no extra space. Consider what this new dimension in control means to your critical production jobs. Write for catalog PB-W.



FOSDICK THE FOSDICK MACHINE TOOL COMPANY
Cincinnati 23, Ohio



Can a standard bearing offer you "more bearing" for your money?

It can if it's made by SKF—because all SKF bearings, both ball and roller, offer special qualities at "production" bearing prices.

Take the single-row deep-groove ball bearing featured here, as an example. SKF designs and builds this type to sustain heavy radial load and thrust load in either direction. Furthermore, it is engineered to run smoothly and quietly at normal speeds with grease lubrication—and at high speeds with oil.

Yet this is a standard SKF ball bearing, mass-produced by automated production equipment at our plant at Altoona, Pa. You can quickly get this bearing in over 100 sizes, ranging from ⅛" to 15.748" O.D., and in a variety of seal, shield and snap-ring combinations.

But why not find out what SKF offers in bearing quality, availability and economy? Just call the SKF branch office nearest you.

4001

Spherical, Cylindrical, Ball, Tyson® Tapered and REED Miniature Bearings

EVERY TYPE—EVERY USE
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SKF INDUSTRIES INC. PHILADELPHIA 32 PA

FROM CREATIVE CRUCIBLE: HIGH SPEED STEELS THAT MAKE BETTER TOOLS POSSIBLE

UNGROUND CLASS "C" HOBS, *made from Crucible's M2S, consistently meet runout tolerances as required.*

CIRCLE 227 READER SERVICE CARD

ACCURATE HOBS— WITHOUT GRINDING!

Toolmakers hold hob tolerances to less than 0.001" without finish grinding—because of improved manufacturing skills and continually improved Rex® High Speed Steels.

Today's toolmakers are not only producing accurate unground hobs to closer tolerances—they're also making them stronger, longer-lasting and with fewer grinding stresses.

What is behind this development? It's the skill of the toolmakers—combined with continuing Crucible developments that improve the quality of Rex High Speed Steels. Crucible tool steel metallurgists, working closely with producers of fine precision tools, are able to devise mill manufacturing practices to provide steels ideally suited to specific applications.

At Crucible, Rex High Speed Steels have always been produced under the close personal supervision of the most experienced men in the industry. Today, these men utilize the most advanced electronic instrumentation to assure the production of highest quality steels. For example, they use precision instruments to control the temperature of the molten metal, in the melting furnace, so each heat is produced under identical conditions. New techniques permit greatly improved deoxidation of the liquid steel. New ingot mold designs provide freedom from segregation when the steel solidifies. And all Rex High Speed Steel billets are inspected ultrasonically before they are rolled or forged.

As a result, Rex High Speed Steels continue to make the best hobs because they offer:

more uniform distribution of carbides throughout the section. This ensures minimum size change, greater predictability in heat treatment, greater hardenability and more uniform hardness in the heat-treated tool:

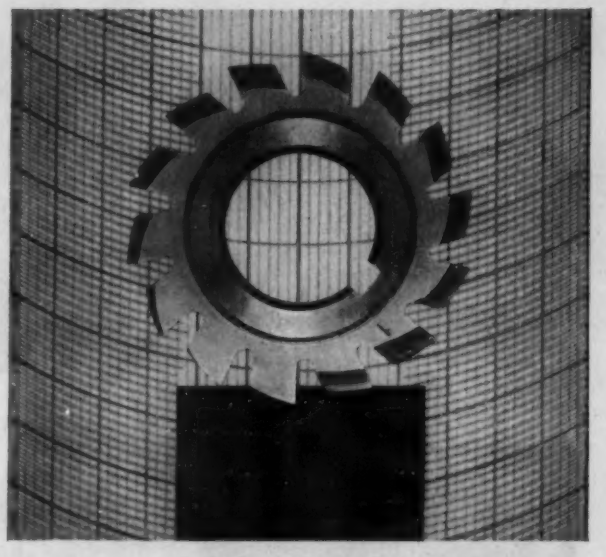
more uniform distribution of sulfides in the free-machining grades. And this provides improved machinability and superior surface finish.

Single-Thread Gear-Hob Tolerances (in Ten Thousandths of an Inch)

	DIAMETRAL PITCH										
	1 Thru 1.999	2 Thru 2.999	3 Thru 3.999	4 Thru 4.999	5 Thru 5.999	6 Thru 8.999	9 Thru 12.999	13 Thru 19.999	20 Thru 29.999	30 Thru 50.999	51 and Finer
RUNOUT											
Outside Dia. C	50	45	40	25	20	17	17	12	12	10	8

Table: Metal Cutting Tool Handbook

FINAL PROOF OF A HOB'S ACCURACY. *This lead variation chart, produced by a special electronic recorder, provides a check of every tooth in the hob. Checks are made "against perfection"—so, any deviation shows up on the chart. Photomicrograph shows tooth area's structure and the uniform distribution of carbides in Crucible Rex M2S. (Photo: 100X dia.)*



BETTER TOOLS, THROUGH BETTER STEELS. *The constant improvement of Rex High Speed Steels ensures the increasingly greater performance of fine twist drills, taps, broaches and cutters—as well as hobs.*

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CIRCLE 228 READER SERVICE CARD

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ELMIRA, N.Y.

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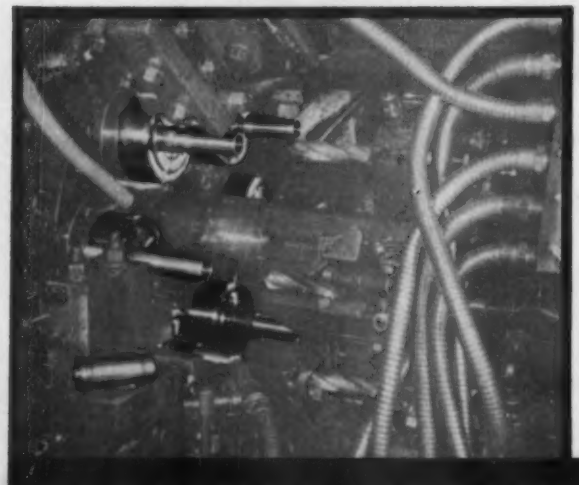
Specify **HARDINGE Style "S" Sure-Grip Master Collets and Pads**

and **HARDINGE Style "B" Master Feed Fingers and Pads**

Photo of Model 601 New Britain Automatic courtesy New Britain-Gridley Machine Division.



Your automatics perform best with HARDINGE Master Feed Fingers and Master Collets. The name HARDINGE is your guarantee of accuracy and durability . . . allows you to reap the full benefit of the inherent accuracy of your machines.

HARDINGE Master Collets are ***the only masters with no work pressure on the screw*** . . . last longer . . . retains accuracy.

HARDINGE Master Feed Fingers and Pads save 30% to 80% over conventional solid feed fingers.

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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SEE IT AT BOOTH 427 ASTE SHOW, April 21-28 • DETROIT

pre-set tools to accurate part dimensions outside the machine with new Microbore® System

SIMPLE 4-STEP PROCEDURE

1. To set up pilot tool, insert Microbore "Pre-Set" unit in boring bar. Adjust to part dimension by trial cut and final setting using Micrometer Vernier adjustment.

2. Remove adjusted pilot tool from the boring bar and install in the standard Microbore setting block.

3. Position indicator anvil on high point of pilot tool in setting block and adjust indicator to zero.

Eliminate trial cuts... change tools in seconds... simplify tool maintenance

Using a standard setting block and indicator, Microbore tools can now be pre-set to accurate part dimensions outside the machine and quickly locked in the boring bar or tool holder without further adjustment.

"Pre-Set" eliminates scrap parts due to trial and error set-up and greatly reduces down time for worn tool point adjustment. "Pre-Set" encourages the operator to keep sharp tools in the machine assuring greater accuracies and produces the maximum number of pieces per tool grind by minimizing breakage due to dull tools.

"Pre-Set" also makes it possible to replace worn tools without changing the entire boring bar or tool holder—eliminates the need for stand-by bars —simplifies tool grinding and maintenance.

Microbore System of "Pre-Set" tooling may be applied to boring, turning, facing and chamfering operations and is especially suited to production and automated operations where machines must maintain peak production on long runs. Write for complete information.

4. Adjust gage pin to same zero setting. Any number of additional tools may now be pre-set and interchanged with pilot for precision boring the same diameter.

If necessary to pre-set for depth of bore, tumble block to adjacent side and repeat procedure.

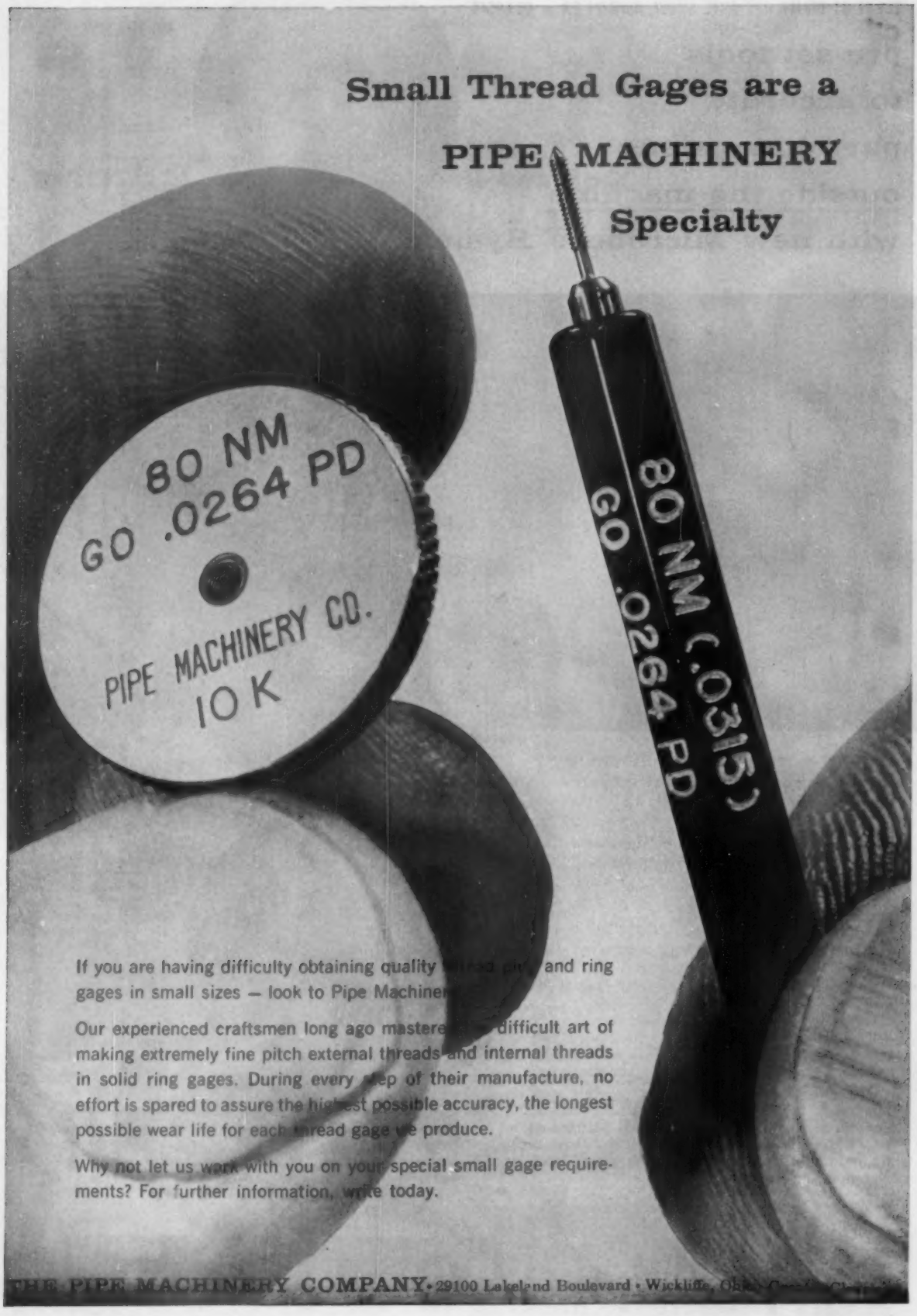
The DeVlieg Microbore System of Adjustable Precision Tooling includes Standard Microbore Boring Bars and Boring Bar Sets, Special Cluster Tooling, Flash-Change Tooling and Tool Holders, Flash-Change Replacement Bridgeport Spindles, Turret Lathe Turning Heads and Adjustable Boring Heads.

DEVLIEG MICROBORE® SYSTEM

DE VLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

CIRCLE 230 READER SERVICE CARD


Small Thread Gages are a
PIPE MACHINERY
Specialty
80 NM
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80 NM (.0315)
GO .0264 PD
If you are having difficulty obtaining quality
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gages in small sizes — look to Pipe Machine
Our experienced craftsmen long ago master
difficult art of
making extremely fine pitch external threads and internal threads
in solid ring gages. During every step of their manufacture, no
effort is spared to assure the highest possible accuracy, the longest
possible wear life for each thread gage we produce.
Why not let us work with you on your special small gage require-
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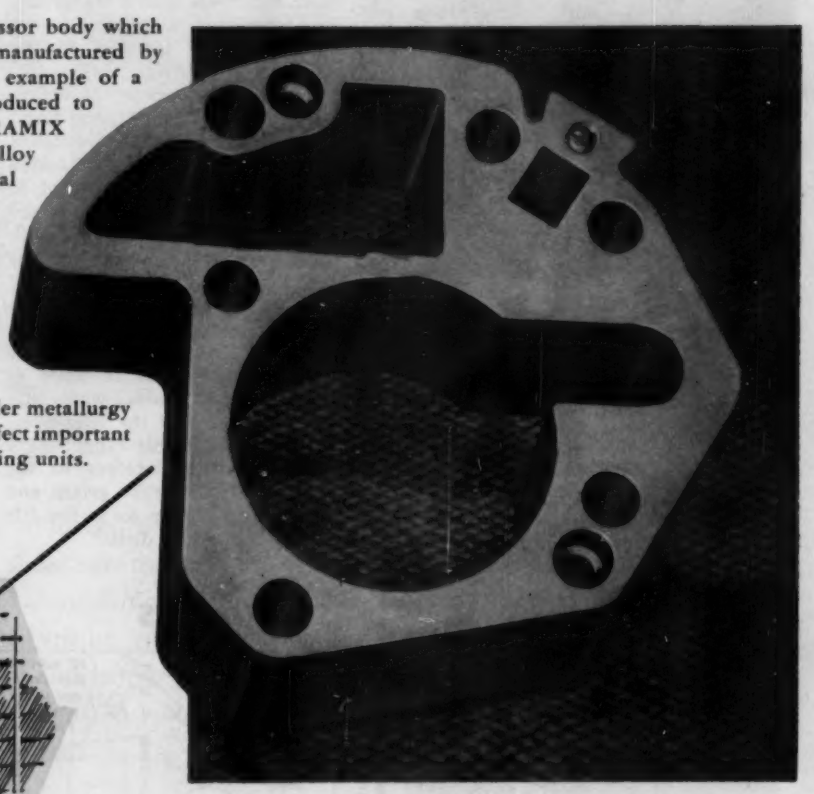
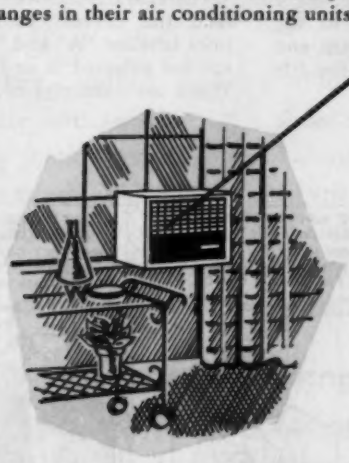
THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio

GRAMIX® COMPRESSOR BODY IS VITAL PART IN GENERAL ELECTRIC AIR CONDITIONER . . . this GRAMIX part is a new concept in powder metallurgy techniques . . . engineered to meet requirements of GENERAL ELECTRIC's new compressor design

This large, complex shaped compressor body which is employed in air conditioners manufactured by General Electric is an outstanding example of a GRAMIX part engineered and produced to exacting specifications. As in all GRAMIX products of powder metallurgy, the alloy was created to meet exacting physical properties required in this particular application. Correct briquetting, controlled sintering procedures, precise finishing operations and rigid quality control throughout the manufacturing process assures General Electric uniform, dependable GRAMIX parts. The production of this body as a product of powder metallurgy has also enabled General Electric to effect important design changes in their air conditioning units.





This part is shown full size. Actual weight: 2¼ lbs.

Write today for these helpful engineering manuals. Engineering Bulletin No. 18 covers design and metallurgical requirements and alloy selection of GRAMIX bearings. No. 19 contains facts about GRAMIX Machine Parts and No. 21 contains general information on GRAMIX products from Powder Metallurgy. Get your copies now.

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LETTERS

to the editors

330 W 42nd St, New York 36, NY

Cutting-tool Evaluation

Dear Sirs:

The article, "How to evaluate cutting tools," which appeared under my name (*AM*—Jan 11 '60, p82), is a severe abridgement of a National Twist Drill & Tool Co Research Dept report entitled, "The Evaluation of Cutting Tools." In the abridgement one outright error was made, and a few points may have been raised which were not adequately clarified in the article.

The error relates to the definition of the 95% confidence limit. The article states that this means "that all but 5% of the tools tested have averaged cutting life of 66 holes ±4.1 holes. Reference to the plot labelled "Normal Distribution" on page 83 shows that this can not be the case.

The correct statement should be that the average life of the entire group of drills from which the 77 were selected can be stated as 66 holes ±4.1 holes, with only a 5% chance that the true average lies outside this range. Note further that this refers to the average of the entire group and gives no indication as to the life of any individual drill.

When the article was in proof form one of your editors raised the question as to why there were only 17 points on the graph which purported to show the performance of 77 drills. Perhaps others have raised this same question. The answer is that the drill lives were grouped by five-hole increments, and a single point represents all of the drills having the same life. The plotting position of the point on the graph is the mid-point of the plotting positions of all of the drills having the same lives.

Further, there is a label at the top of this graph: "% of Drills Surviving." This actually referred to an inverted scale across the top of the graph which was omitted by your draftsman. This scale should have started with 99.99 at the left-hand end of the graph and extended to 0.2 at the right-hand end. It is obvious that the percentage of drills failed and the percentage of drills surviving along any vertical line must add up to 100%.

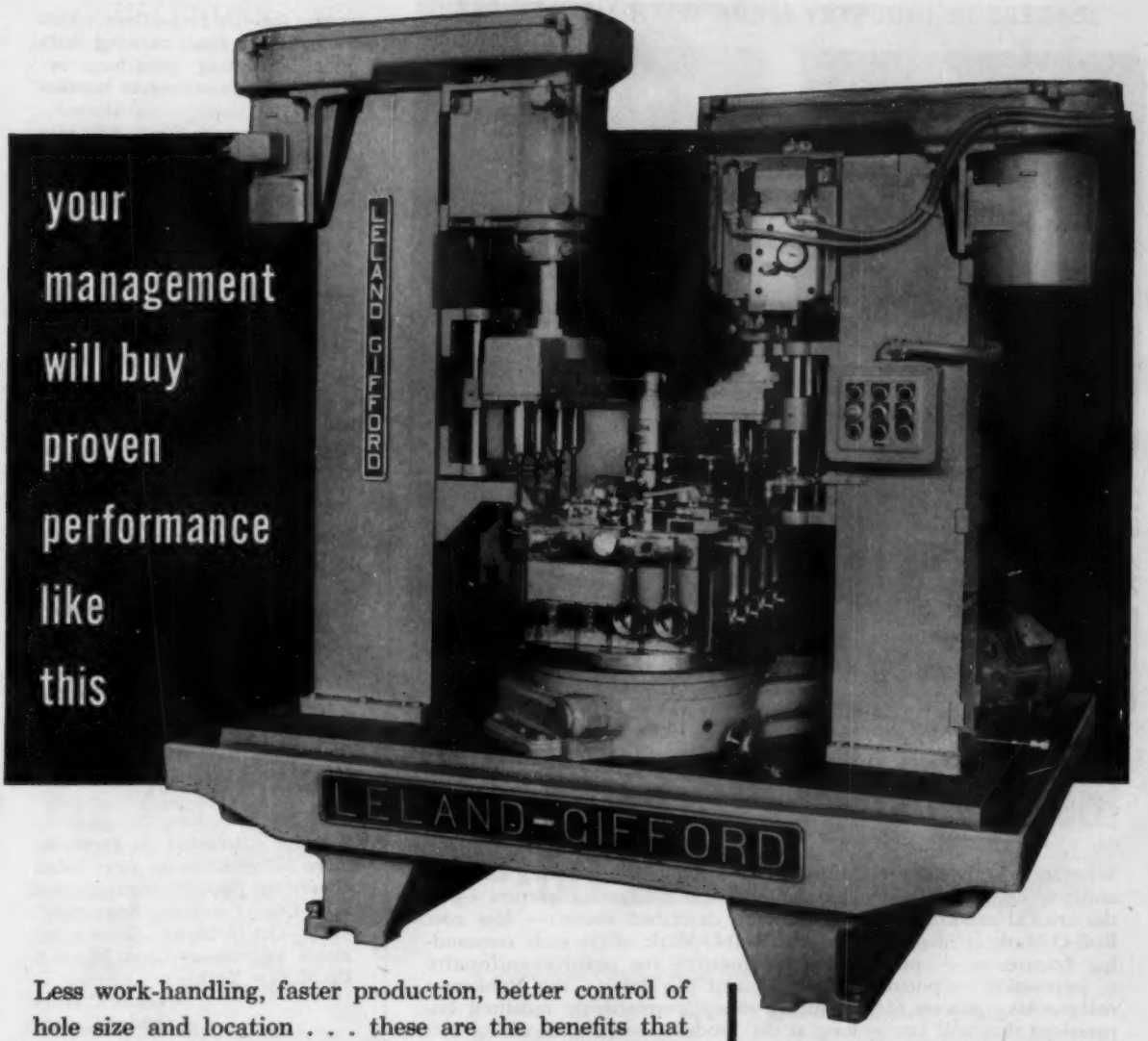
The chart captioned "Don't extend the curves" contains two lines labelled "A" and "B" which are not referred to in the article. These are examples of other im-

SHOPMATES

N. Jarvis

HE WAS GONNA THROW THAT BAD PART OUT IN THE CREEK BUT HE GOT THE WRONG WINDOW AN' THREW IT IN THE WHIP'S OFFICE INSTEAD!
IF HE'D A THROWED IT IN THE CRICK THE WHIP'D A BEEN OUT THERE SNOOPIN' AROUND—HE'S BEEN CONKED WITH SCRAP BEFORE!?
SLAM
N. JARVIS

your management will buy proven performance like this



Less work-handling, faster production, better control of hole size and location . . . these are the benefits that quickly justify investment in Leland-Gifford special drilling machines. We will gladly work up your rough notes into a fully developed proposal and supply the facts and figures you need to sell management on your suggestions for better precision drilling methods.

For automatic drilling at its best be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill ⅛" oil splash hole and 3/64" metering hole in connecting rod.

THE MACHINE: A Leland-Gifford two-unit special with one No. 4 and one No. 3 self-contained drilling unit. Index table is loaded with four parts in each station and clamped by hydraulic clamp cylinders. Four-spindle multiple head at left station drills splash holes to depth; directed air jets at rear station clear chips, four-spindle head at right station drills metering holes. Production of 620 pieces per hour is easy at 100% efficiency.

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Above left—Tooled for marking part numbers on the I.D. of steel rings—component parts for aircraft engines.

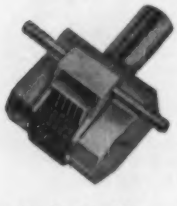
Above right—Tooled for marking aircraft engine rocker box covers.

ROLL-O-MARK'S Versatility

Speeds up metal marking

All-pneumatic Model 50P1

Whether it's an aluminum forging that requires a marking machine sensitive enough to provide a shallow mark without distortion — or the critical marking of the steel ring described above — low cost Roll-O-Mark is ideal for the job. Roll-O-Mark offers such outstanding features as — pneumatic table pressure for positive uniformity of impression — pneumatic operation of die slide — the Noblewest *roll-marking* process for producing sharp, permanently indented impressions that will last as long as the product itself . . . marking better, faster (up to 1200 pieces per hour), and at lower cost. Prompt delivery can be made on Roll-O-Mark. For specifications and prices, or comprehensive marking catalog, write Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.



NOBLEWEST Automatic Numbering Heads are standard in the marking industry. They offer unlimited applications for constant, selective and consecutive numbering. Made to the most exacting standards of quality, they are competitively priced.

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NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

MARKING
NUMBERING
EMBOSSING
GRADUATING

proper tool-life projections which could result from running tests under operating conditions remote from those used in production.

In checking our files I find that we have available a limited number of copies of the complete report upon which this article was based. It contains some examples of the graphical analysis of actual drill tests and may make this phase of the work easier to understand than does the simple formula presented on page 83 of the article. If any of your readers would be interested in studying the entire report, we will be happy to send a copy to anyone who will send us a written request.

C J Oxford, Jr
director of research
National Twist Drill & Tool Co
Rochester, Mich

Readers who would like to receive a copy of the report offered by Mr Oxford can request it by circling No. 50 on the Reader Service Card. We will be glad to forward the requests—Ed.

Finishing

Dear Sirs:
We are interested in receiving more information on your "Metalworking Report" item entitled "One-Coat Porcelain Enameling" (*AM*—Oct 19 '59, p3). What is the street address of Chas Pfizer & Co of New York?

Leslie C Hilty
Oakland, Calif

The complete address is Chas Pfizer & Co, Inc, 800 Second Ave, New York 17, NY—Ed.

"I think he's trying to tell us something."

CALENDAR

National Screw Machine Products Association -- Annual Meeting, Apr 3-6, Hotel Ambassador, Los Angeles, Calif.

Society of Automotive Engineers—National Aeronautic Meeting, Production Forum, and Display, Apr 5-8. Hotel Commodore, New York, NY.

Annual Joint Conference on Automatic Techniques (ASME, IRE, AIEE)—Apr 18-19, Cleveland Sheraton Hotel, Cleveland, Ohio.

American Machine Tool Distributors Association—Semi-annual Meeting, Apr 18-20, Greenbrier Hotel, White Sulphur Springs, W Va.

Metal Treating Institute—Spring Meeting, Apr 20-22, British Colonial Hotel, Nassau.

American Society of Tool Engineers—Tool Show, Apr 21-28, Detroit Artillery Armory, Detroit, Mich.

Metal Powder Industries Federation — Annual Meeting and Powder Metallurgy Show, Apr 25-27, Drake Hotel, Chicago, Ill.

American Welding Society—Annual Convention and Welding Show, Apr 25-29, Great Western Exhibit Center and Biltmore Hotel, Los Angeles, Calif.

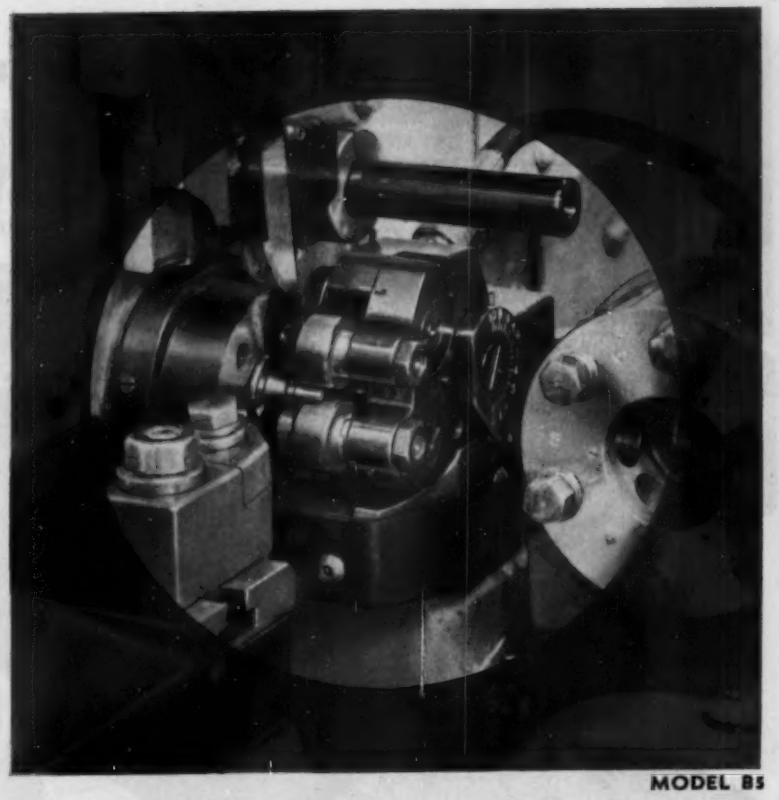
Instrument Society of America—Instrument-Automation Conference and Exhibit, May 9-12, Civic Auditorium and Brooks Hall, San Francisco, Calif.

American Society for Metals — Southwestern Metal Exposition and Congress, May 9-13, State Fair Park, Dallas, Texas.

American Foundrymen's Society—Castings Congress and Exposition, May 9-13, Convention Hall, Philadelphia, Penna.

Machinery Dealers National Association—Annual Convention, May 11-14, Edgewater Beach Hotel, Chicago, Ill.

American Institute of Industrial Engineers — National Conference and Convention, May 12-14, Sheraton-Dallas Hotel, Dallas, Texas.



MODEL B5

New Thread Rolling Attachment for # 00 *Brown & Sharpe*

- *Reduces Pressure on Spindle*
- *Produces Higher Quality Threads on steel, brass and aluminum*
- *Increases Threading Capabilities*
- *Eliminates Secondary Operations by Threading Behind Shoulders*
- *Threads Rolled Close to Collet*
- *Reduces Inspection Costs*

With this latest Reed Attachment the threading capacity of your #00 Brown & Sharpe can be greatly increased. The attachment has a diameter capacity of up to 5/16 inch and maximum thread length of ½ inch. It is easy to set up and operate and precision adjustments assure accurate matching and positioning.

REED RTD TRA-174

REED ROLLED THREAD DIE CO.

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MARVEL HIGH SPEED EDGE HACK SAW BLADES

MMT-PE

should be YOUR FIRST CHOICE

This is no time for "second-best" performance from your hack sawing machines. Today, every cut you make on a hack saw should be done as quickly, accurately, and economically as possible.

The *blades* you use can often mean the difference between mediocre work and top performance from your hack sawing machines. Here are 3 big advantages unbreakable MARVEL High-Speed-Edge Hack Saw Blades can bring to your cutting-off operations:

1 HIGHER PRODUCTION . . .

MARVEL High-Speed-Edge Blades are shatterproof and can be worked harder and faster than any other blade. They will withstand the highest speeds and heaviest feeds attainable on any hack sawing machine with complete safety. Machine operators working with MARVEL Blades naturally apply greater tensions, feeds, and speeds because they know they are safe from personal injury accidents. The result is faster cutting-off.

2 GREATER ACCURACY . . .

MARVEL Blades can be safely tensioned from 200% to 300% more taut than ordinary blades. Higher blade tensions produce greater rigidity of the high-speed-steel cutting edge, resulting in maximum attainable accuracy of cut-off blanks.

3 LONGER BLADE LIFE . . .

Each MARVEL High-Speed-Edge Hack Saw Blade is triple tempered to assure maximum toughness of the cutting edge. MARVEL Blades not only give you longer life, they assure a more efficient cutting life and lower blade costs.

Why gamble? Demand MARVEL Blades by name, and be sure you're getting the best blades on the market. Leading Industrial Distributors have them in stock.

B-1123

Write for the new MARVEL Cutting Tool Bulletin and the name of your nearest MARVEL Distributor.

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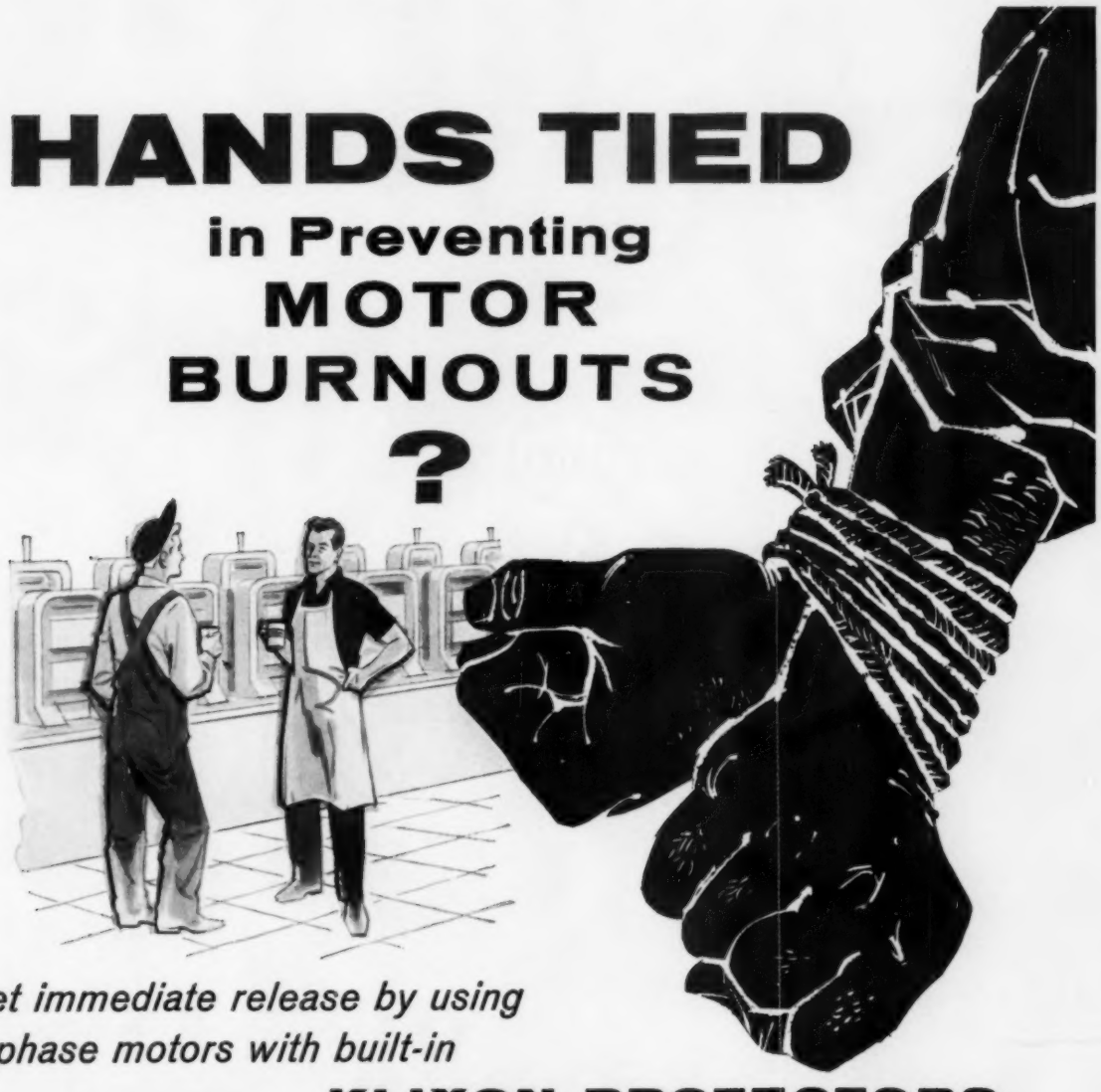
MARVEL Metal Cutting SAWS
Better Machines–Better Blades

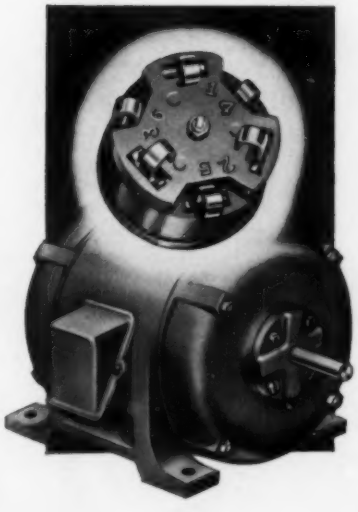
HANDS TIED

in Preventing MOTOR BURNOUTS ?



Get immediate release by using 3-phase motors with built-in

KLIXON PROTECTORS



Here's What KLIXON Protection Gives You: ● *Maximum Motor Output* ● *Reduced Motor Repairs and Replacements* ● *Less Production Down Time*

Motor burnouts due to overheating need not occur in your plant, not if you specify and use three phase motors that have built-in KLIXON Protectors.

Built-in by the motor manufacturers, KLIXON Protectors safeguard motors from overheating due to — prolonged overloads, unbalanced voltage, stalling, failure to start, increased ambient temperatures, lack of ventilation, plugging or reversing duty, and single phasing.

Here's how they operate — should the motor become overheated from any of the above conditions, the KLIXON Protector snaps the power "off". As soon as the motor cools to safe operating temperature, it snaps the power "on" again permitting normal operation.

Guard against motor burnouts in your equipment by specifying KLIXON protected motors on new equipment . . . replacing old motors with KLIXON protected motors.

KLIXON protected motors are available from your motor supplier. Ask him about it. The savings are great, the additional cost is slight. Write for bulletin PR-1243, today.

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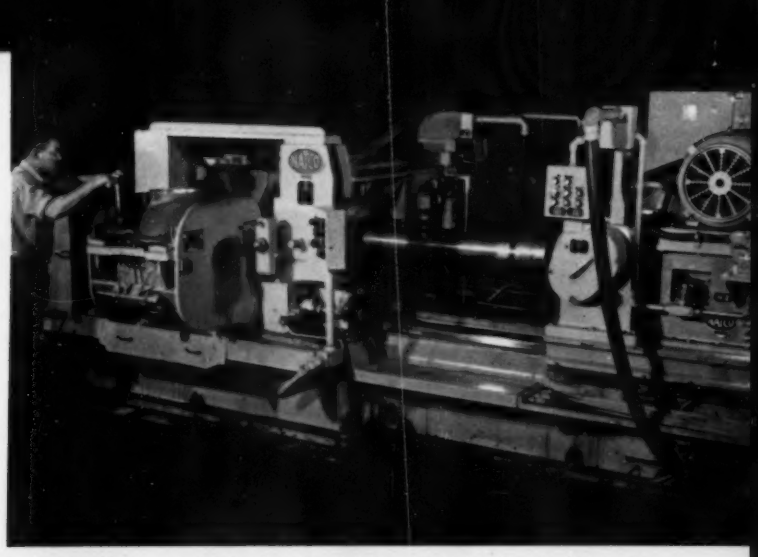
Spencer Products: Klixon® Inherent Overheat Motor Protectors • Motor Starting Relays • Thermostats • Precision Switches • Circuit Breakers

CIRCLE 238 READER SERVICE CARD

CIRCLE 239 READER SERVICE CARD ►

NATCO

Flopover cradle makes for unobstructed top loading. Holes are bored in two directions without change of setup in this off-highway truck differential carrier assembly.



L-shaped Natco special for boring right-angle holes has both rough and finish cycles. It handles two sizes of parts.

Handling Ease Alone Justifies This Natco Special

This husky Natco does one job well—It bores big holes in hard-to-handle, heavy cast steel parts.

International Harvester Co., Melrose Park, Ill., cuts handling time in half with this Natco special, and look what else it gets: better finish on the bores, longer tool life, improved alignment, tighter tolerances, and more parts per hour. In short, higher quality and greater productivity. And a standard boring mill is released for general purpose chores.

For such extra benefits from specials, call your Natco representative today.

NATCO

The National Automatic Tool Company, Inc., Richmond, Indiana

Only two boring bars with expanding bit heads are needed to bore these several different diameters and faces.

Bits expand from boring heads. Head entering at top bores 4.725″ and 10.250″ holes at the same time.

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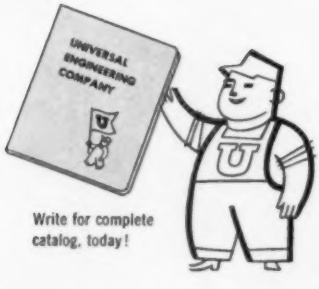
it pays to use UNIVERSAL DRILL BUSHINGS



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214

◄ CIRCLE 240 READER SERVICE CARD

CIRCLE 241 READER SERVICE CARD

SPOT NEWS...

- **Electric autos may roll out of the planning stage this year.** The Kilowatt, a Renault Dauphine converted to battery power, will be introduced this month. It is designed to sell for about $3500, has a range of 60 miles, and costs about a cent a mile to operate. Manufacturer claims 76 orders to date. Detroit's Big Three disclaim interest in electrics, but American Motors and Sonotone pursue research on such a vehicle.

- **Curtiss-Wright is working on a vertical rising plane** that will seat six and have a forward speed of 400 mph. Engineering studies on the four engine craft indicate that it can rise vertically 20,000 feet and attain a 36,000-ft altitude in forward motion. It will use C-W's steel—fiber-glass propeller.

- **Molten aluminum will be hauled 105 miles by truck** from Alcoa's Warrick (Ind) Works to General Motor's Bedford foundry. Special GM trucks, each capable of holding 6000 to 12,000 lb of the liquid metal, are now being designed. GM uses aluminum for the Corvair engine block, plans to use it for the forthcoming Buick and Oldsmobile compacts (*AM/MM*—Mar 7 '60, p75).

- **Two completely new press lines,** comprising 14 of the most modern presses now available, will be installed in the Fisher Body plant in Hamilton, Ohio. New machines, reportedly including some new Bliss underdrive presses, will replace presses 25-35 years old.

- **High-temperature ceramics that are dimensionally stable** and oxidation resistant at temperatures above 4000 F are under development at Boeing Aerospace Division, Seattle. Successful tests have been run on hafnia, zirconia, thoria, and compounds of hafnia-thoria, hafnia-lanthana and hafnia-neodymia.

- **Group of U S engineers and technicians** left by Air France Boeing 707 on March 18 to spend a week visiting French plants making drilling machines, grinders, lathes, milling machines, jig borers, presses, and control equipment. Program includes a dinner for each visitor in the home of a French manufacturer, sightseeing, shopping, and evening entertainment at total expense of $734.70 for the trip. Manufacturers Associates, 92 Liberty St, New York City, arranged the trip.

- **The Japanese machine-tool survey team touring the Middle East** (*AM/MM*—Feb 22 '60, p79) reports that the biggest potential market for Japanese machine tools exists in Egypt, Turkey, and Iran, and to a lesser extent, Pakistan. Plans to develop these markets are hindered by foreign exchange payment difficulties.

- **Three out of four plants established under Puerto Rico's** Operation Bootstrap (*AM*—Jan 27 '58) plans to continue operations when their tax holiday expires. The Economic Development Administration surveyed 59 enterprises whose exemptions will end in the next four years. Forty-four intend to stay, eight will probably leave, seven are undecided.

- **Russian seven-year plan ending in 1965** calls for erection of five factories for production of diamond-tipped tools. Plants, using diamonds from new Siberian mines, will be built in the northern Caucasus, the Ukraine, in Siberia, and near Moscow.

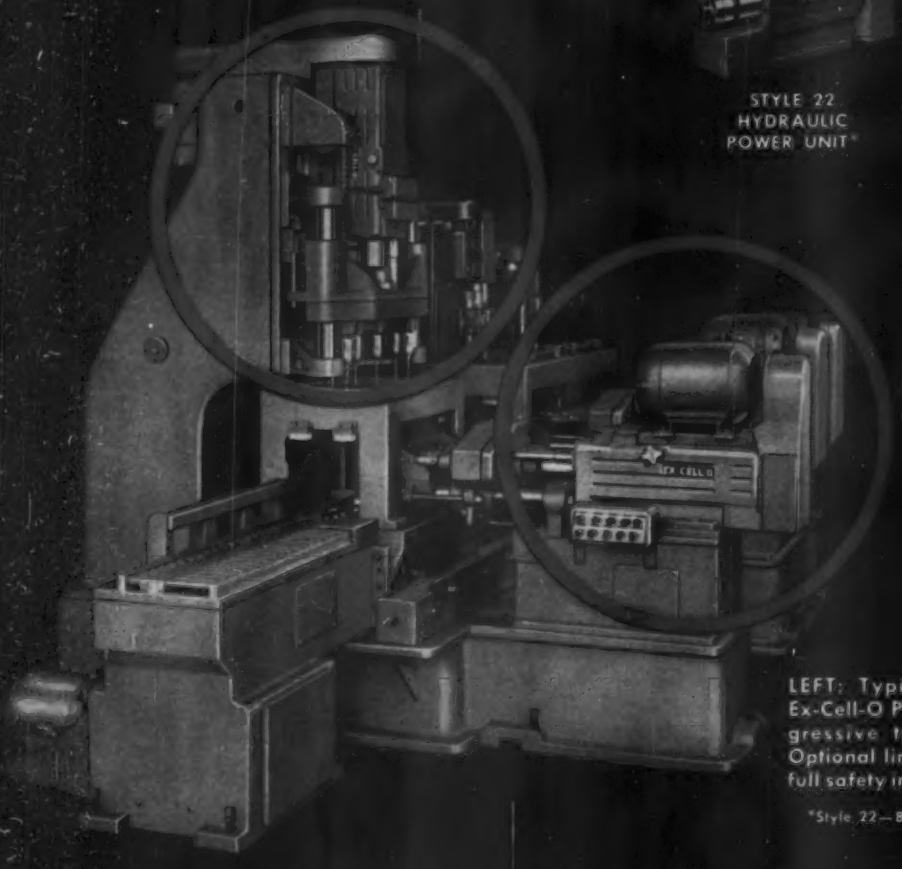
- **Diesel engines designed to withstand the shock** of a hydrogen bomb blast are being built by Worthington Corp's Compressor and Engine Division in Buffalo. First five, of the 24 in construction, have been delivered to Lowry Air Force Base, Colo, for installation in the nation's first underground ICBM base.

XLO EX-CELL-O FOR PRECISION

STYLE 22
HYDRAULIC
POWER UNIT*

STYLE 28-A
HYDRAULIC POWER UNIT

STYLE 20
HYDRAULIC POWER UNIT



LEFT: Typical application shows six Ex-Cell-O Power Units installed on a progressive transfer-type machine tool. Optional limit switch assemblies provide full safety interlock and start-cycle control.

*Style 22—8-inch Stroke; Style 22-L—12-inch Stroke

POWER + VERSATILITY

58-11

With Ex-Cell-O Quill-Type Hydraulic Power Units

Why buy a power unit that's made to do just one job—when a single, low-cost Ex-Cell-O Hydraulic Power Unit will do more work in a broad range of applications?

Compact Ex-Cell-O Power Units are used for drilling, spot-facing or reaming in special-purpose machines. When these operations are no longer desired, the units can be quickly and easily relocated to perform numerous other operations.

Because of their simple, precise control in automatic cycling, they've even been used in light, high-production broaching, material handling and many unrelated operations.

Ex-Cell-O Hydraulic Power Units are self-lubricated, perform in fast cycles, and are easy to install, particularly where space is at a premium.

For complete information on Ex-Cell-O Quill-Type Power Units, and how they can lower your production costs, call your local Ex-Cell-O Representative or write direct.

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

WASHINGTON...

Push for more exports...

Washington has begun a program to promote exports of U S goods. As part of the program, the Commerce Dept is holding a series of meetings with industry groups to solicit views on how U S export trade might be expanded. Specifically, Commerce is looking for industry ideas which can be used to guide official U S trade negotiators—in GATT (General Agreement on Tariffs and Trade) and elsewhere.

As a by-product of the conferences, Washington expects to get details on what gripes U S exporters in their dealings with foreign markets. This will lead to official U S representations to the foreign nations on behalf of exporters here.

So far, the export promotion program shapes up into these elements:

- **The Export-Import Bank** will grant limited credit guarantees against specified political—but not commercial—risks involved in selling abroad.
- **Government assistance abroad** for U S exporters will be increased and improved in quality.
- **The Commerce Dept will bolster** its information services here for exporters, seek closer liaison with the exporting community, and try to spur business to "organize itself more effectively to compete in foreign markets."

There's a sour note to the new program already. Some officials and businessmen here are saying privately that the program is too modest to give more than a marginal boost to U S exports.

Machine-tool builders meet...

One of Commerce's first export expansion meetings was held with the machine tool industry here on March 8. Representatives of 14 companies attended.

The machine-tool men complained that U S exporters are at a disadvantage in competition against tool builders from countries such as West Germany whose governments provide financing credits to private business.

They also reported that tariff concessions made by certain foreign countries are frequently offset by new internal taxes levied against imports of U S goods. France, for example.

A final complaint from tool exporters was aimed at the administrative delays in Mexico and other Latin American nations which snag the admittance of U S goods even though the shippers' licenses are in order.

The builders reported that export sales of general purpose tools are sliding off, but that foreign orders for special-purpose automated machines are continuing to come in at high levels. **Some of the builders sought** official advice on whether to seek new business in Russia. Commerce Dept officials were unable to say anything definitive. But other builders were skeptical about the potential market for U S tools behind the Iron Curtain.

Depreciation legislation...

New legislation ran into opposition at the Ways and Means Committee hearings. Treasury wants to change the law to require companies to pay the 52% corporate income tax rate on income from the sale of fully depreciated equipment. As things stand now, the law permits a 25% capital gains rate on income from such sales.

The Treasury says if its legislation is passed, it will instruct IRS agents to be more lenient in allowing businessmen the rate of depreciation they think they should have. Now IRS agents tend to adhere to the book—in this case, the famed Bulletin F.

The Treasury estimates that taxpayers would be paying perhaps as much as $300 million more under the proposed legislation than they are paying now, but this would supposedly be offset by the more liberal depreciation allowances.

George Terborgh of the Machinery and Allied Products Institute said, "There is often a wide gap between the declared policy of Washington officials and the practice of revenue agents in the field. Cases are constantly being brought to our attention in which field agents maintain positions that run counter to Washington policy."

Skeptics speak out...

In other words, there was considerable skepticism about the Treasury's record in getting IRS field agents to go along orders from the top. It's believed that a minimum requirement is that something more positive be required—for instance, that language be written into the legislation or the legislative history that would put real leverage on the IRS man who audits company tax returns.

Terborgh suggested alternative proposals, too, in the direction of more liberal depreciation per se.

The desire for modification of the Treasury's legislation can't help but shade somewhat the chances for enactment of the law.

ANOTHER EXPANSION to Better Serve Industry in the Soaring Sixties

PLANT No. 4—ELK RAPIDS, MICHIGAN

PLANT No. 2—DETROIT, MICHIGAN

PLANT No. 3—MANCELONA, MICHIGAN

The recent opening of our Plant No. 4 in Elk Rapids, Michigan, marks the fourth expansion in our manufacturing facilities since we set up in business 35 years ago. In the intervening years, we have earned an international reputation for designing and building money-saving machine tools for many types of industries. We have also diversified our engineering and production talents so that our machines, which originally were specialized in metal-cutting operations, now reach into the nuclear power, electronic, chemical, drug, cosmetic and food industries and are used in processing many household products in everyday family use. To the many people who have helped us build this business, we say, "Thank you, sincerely."

SNYDER CORPORATION
and our subsidiary

ARTHUR COLTON COMPANY

3400 E. Lafayette Avenue • Detroit 7, Michigan

PLANT NO. 1—DETROIT, MICHIGAN

DETROIT...

A little silver lining...

Steadily brightening car sales in February resulted in a slight upgrading of March production schedules. First-quarter activity should now total two million cars. Pacing sales are some that have posted all-time records as of month's end. They include Pontiac with 32,204 retail transactions; Chevrolet with a fantastic combined figure of 173,835 car and truck deliveries; Rambler, no newcomer to the list, with 28,312 for its 29th consecutive record month; Dodge doing its best since 1952 with 27,972 to top Plymouth and triple last year; and old standby Cadillac with 13,576.

Gloomchaser...

Chevrolet's Edward N Cole, just returned from a two-week tour of dealers, says: "We're not hanging out any crepe here." He found his dealers enthusiastically bent on clobbering Ford and highly optimistic for 1960. Cole reported 232,000 Chevrolet and 35,000 Corvair sales for the first two months of this year, and stated that since standard-size car sales are running ahead of last year, the Corvair business can be considered as a plus.

He is sticking to his prediction that the industry will sell 7,000,000 passenger cars, including about 500,000 imports, in 1960. His reason is a region-by-region improvement in sales that follows the traditional pattern of the spring surge. The upswing has already started in the southeastern states, and is now spreading to the Pacific Coast. The southwestern states, the Atlantic Coast including New England, the north central states, and finally the Rocky Mountain area should follow in that order.

Cole states that "at the moment, Chevrolet has no particular interest in producing a car to compete with the small European product because of the limited opportunity presented by this market" but hastily added that "this would change."

He noted that foreign builders could produce a given car for about 80% of American costs, including the import duty of 8.5%. Observers remember, however, that the above quotation is almost word for word the line handed out during the early gestation of the Corvair.

An added note for 1961...

Our preview of 1961 models in the March 7 issue gave the most up-to-the-moment rundown on what to expect in auto styling and engineering in the future.

Further digging brings to light that Rambler is going to stick to its current body shell for 1961, and that the American series will be augmented by a convertible. And speaking of future plans . . .

Why the secrecy?...

The secrecy surrounding forthcoming new cars is based upon an unproved suspicion that premature publicity will hurt the sale of current models.

This questionable attitude makes for some peculiar situations for suppliers, and reporters too. Chevrolet officials were answering queries on the Corvair with "What small car?" long after tooling orders were placed. "For the moment at least we are not considering it" has become the standard line to indicate that a given new project is in the advanced planning stage.

The gap in communication caused by such secrecy can really hurt a supplier. One company, for example, spent nearly $1 million developing a transistorized ignition, only to find the horsepower race ended by executive fiat and its new system suddenly useless.

It is well known that General Motors plans a switch to unitized bodies in 1963. Yet frame suppliers are still presenting elaborate engineering seminars on the merits of chassis-type cars. They should, instead, be preparing to enter some other business, and probably would if adequately forewarned.

Another tragic case is Midland-Ross (a frame supplier to Chrysler) which had to shut down in the summer of 1959. Of the 2500 workers suddenly without jobs, only 300 have so far found employment.

A peanut-butter engine?...

Rolls-Royce Ltd recently displayed an automobile engine that can run on anything from peanut butter to creosote, or on more conventional fuels such as kerosene, diesel oil, aviation gasoline, or just plain gasoline. Development was sponsored by the British army, with an eye toward military vehicles.

The engine probably will replace all current engines in British military vehicles, according to the report from London.

When asked if Rolls-Royce might install such engines in its famed limousines, a company official replied, "Do persons owning Rolls-Royce limousines eat peanut butter?"

How you're ahead with Danly's years-ahead design

EVEN ONE LESS DAY OF DOWNTIME PER YEAR

MMT=PE

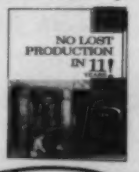
RETURNS MORE THAN 5% OF YOUR PRESS COST

Downtime on an important production press is far more expensive than the direct maintenance costs involved. Schedules are disrupted – workers and machines stand idle—production is lost—profits suffer. Production time on a $30,000 press is very conservatively worth $30 per hour. On this basis alone, one sixteen-hour day of downtime will incur costs of $480. In a nominal 3-year payout period, one extra day of production per year can repay 5% of your press cost.

Danly presses are engineered to give you that extra day of production, *many times over*. Design innovations years ahead of the industry, and an extra measure of brawn and precision keep Danly equipment on the job month after month, without maintenance interruptions.

Outstanding case in point: the 500-ton, straight side press pictured above has been operating at the General Electric Company's Hotpoint Division Plant at Milwaukee, Wisconsin for *eleven full years* without losing a single day of scheduled production! During that time it has paused only twice for planned maintenance. Seven other Danly presses in this pressroom have equally impressive records of maintenance-free operation.

Savings in maintenance downtime alone can wipe out all price differential between quality and "economy" equipment. Still more profit will be realized from longer die life, improved parts accuracy, and other bonus benefits. For a frank and comprehensive review of these advantages, SEND FOR BULLETIN 300.



DANLY

DANLY

DANLY MACHINE SPECIALTIES, INC., 2100 S. LARAMIE AVE., CHICAGO 50, ILLINOIS

AIRCRAFT and MISSILES... TRENDS

From planes to vending machines...

Diversification into everything from coin-operated vending machines to heavier concentration on electronics and missiles is beginning to bring some stability to the Southwest's aircraft industry. Still, the sting of military cutbacks is sharply felt in both earnings and employment.

Chance Vought, only one to release business figures so far, reports earnings of $4.9 million, just slightly more than half of 1958 earnings. The Dallas-headquartered company's military-order backlog stands at $253 million, off $117 million from a year ago.

Total aircraft-plant employment in the Dallas-Ft Worth area today is about 35,000, down some 15,000 from late 1959 when the current rash of military cutbacks began. Vought has laid off about 9000, Temco Aircraft about 2000, Convair roughly 3500, and Bell Helicopter 500.

Labor negotiators will have these figures in mind at contract talks now in progress at Chance Vought, and slated to start soon at Bell. But management can show that the labor cutbacks would have been greater had diversification steps not been taken.

For example, Temco Aircraft has set up an industrial division to manufacture and assemble, among other things, various coin-operated commercial products. It has also moved more heavily into aircraft maintenance and overhaul work. Looking ahead, Temco hopes to have at least half its sales in the electronic and missiles field by the end of 1961.

Chance Vought has taken the biggest diversification steps by moving into the mobile home manufacturing business and greatly expanding its industrial automation activities. Management is seeking a better balance of defense and non-military work.

Convair still has a major part of the B-58 contract, is building the nose section of the F-106, the booster section of the Atlas, and is doing considerable R&D work in the nuclear-powered aircraft field.

Bell Helicopter has weathered the military cutbacks in good shape. Aside from several military helicopter contracts, Bell also has three commercial models in production.

Prototype space engine...

Republic Aviation Corp reports that a magnetic pinch plasma engine—expected to be a leading factor in development of interplanetary space travel and in steering satellites and moon rockets—has been running continuously for more than 118 hours.

The engine uses nitrogen for fuel and turns it into plasma, a "fourth state of matter" evolving from gases, a state in which the molecules are broken into electrons and positive ions. The plasma is compressed or "pinched" by a cylindrical magnetic field until it is shot out of the compression chamber at high velocity.

As a result of this latest advance, said A E Kunen, manager of the company's Plasma Propulsion Laboratory, Republic plans to begin the immediate design of flyable plasma engines.

AMC reorganization likely...

A special board of Air Force generals headed by Gen Samuel E Anderson, commander of the Air Materiel Command, is making an extensive study of USAF procurement policy and organization. The upshot will probably be a plan for overhauling the AMC setup.

Odds are that the AMC reorganization would be in line with the recent organizational changes ordered for the Air Research & Development Command. The ARDC reorganization was aimed at strengthening the power of major field commands which supervise R&D contractors. It also clarified the responsibilities of ARDC's various field commands, which had become entangled as a result of the new emphasis on missile and space projects.

The AMC reorganization would be aimed—as one Air Force general put it to AM/MM—to "improve our capabilities to evaluate what our contractors are doing."

New R&D contracting stage...

Pressed by rising costs, stringent budget restrictions, and the technological unknowns of manned space flight, the Air Force has introduced an additional contracting step for weapon system development projects. An AF official calls the new step a means to "increase our confidence that we are on the proper development course in a project that promises to be exceedingly expensive."

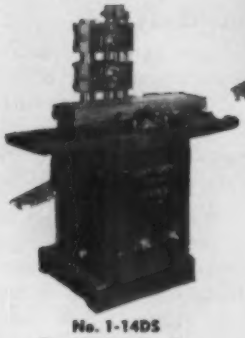
The new contracting stage is formally called "Phase Alpha." It requires prime contractors to "further refine" study proposals submitted during the source selection stage of a new project. Phase Alpha would precede the award of a conventional Phase 1 development contract leading to the fabrication of hardware.

EXTRA RUGGED... SPEEDY... ACCURATE...

to Bring Down Milling Costs!

No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-14. 32" x 9" table . . . 14" table travel...hydraulic table feed... full automatic cycle.



No. 1-14DS
Double Spindle for two milling operations at same time . . . 14" table travel . . . 32" x 9" table.

No. 2-20DS
Double Spindle for two milling operations at same time . . . 20" table travel . . . 42" x 12" table.

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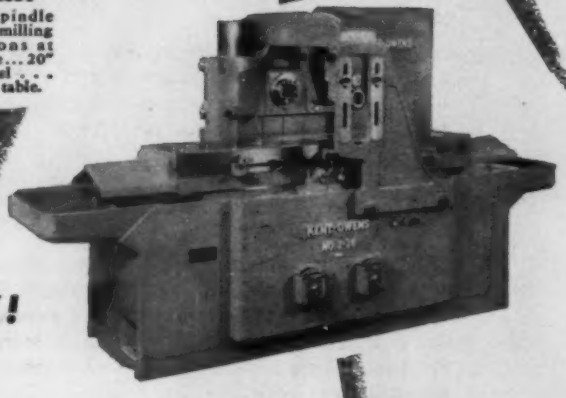
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. . . . 42" x 12" table.



No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

STEP UP SPEED and ACCURACY!

Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout make the difference . . . greater dependability . . . accuracy maintained. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #757 on wide range of hydraulic and hand-operated machines. Let us quote on proper machine complete with tooling for your operation. Also, call on Kent-Owens for special machines. Kent-Owens Machine Co., Toledo, Ohio.

KENT-OWENS
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MACHINE TOOLS...

Big tooling programs in Europe...

Another major round of expansion is on in the rapidly growing European automobile industry.

Fiat, for one, has an important tooling program in progress which will require large numbers of machine tools. Volkswagen too has plans for increasing its productive capacity. It will need machine tools over and above recent purchases.

Ford of England also has money appropriated for adding to its manufacturing facilities. And so does Vauxhall, General Motors subsidiary in England.

These European automotive tooling programs already have generated some orders for U S builders of machine tools. But the bulk of the business has not yet been placed.

European automobile makers have been a prime source of orders for many U S builders of high-production and special-purpose machine tools during the past six to twelve months.

Several substantial orders have come recently from Japanese companies for expansion of automobile manufacture. The Osaka Exhibition at the end of April will attract a number of U S builders who feel that Japan is a good market for American machine tools.

Corvair program cancelled...

The tooling program for expansion of the Corvair engine facilities at Tonawanda, NY, is reported to have been cancelled.

At least some of the machine tools involved in this program are nearly completed. Chevrolet obviously will have to bear the cost of them.

The main reason for the cancellation is not hard to find. Corvair's sales have been running well under the anticipated volume; and there is no sign of a pickup beyond the present ratio to the industry's total sales. More than that, Pontiac had been toying with the idea of using the Corvair engine in a compact car, but has abandoned the idea.

Western tools shown at Leipzig...

Nearly half the machine tool exhibit space at this year's Leipzig Fair in East Germany (February 28 to March 8) was occupied by western European builders. Several dozen West German builders had displays.

A significant number of French, Swiss and Belgian companies also took part. The British, apparently disappointed by the results from the 1959 show, eased off in their interest. Nevertheless Dowding & Doll, Wadkin and Scottish Machine Tool Corp were among the exhibitors from the UK.

The nationalized East German machine tool industry, encouraged by growing interest of the West in cross-curtain trade plus expanding export potentials, is planning on increasing by two-thirds the size of its present machine tool exhibition area at Leipzig. The added space will be ready for the 1963 Fair.

Automatic operations predominate..

Automatic loading and unloading, and multi-station link-line setups, with two or more machines joined by automatic handling devices, were shown at Leipzig by East German builders.

A duplex hobber, twin-spindle deburrer, washer and shaver were coupled together to machine speed-change spur gears for automobile transmissions, at a rate of one gear every minute.

Cone Automatic licenses Renault...

Cone Automatic Machine Co, Inc, Windsor, Vt, has licensed Renault at Billancourt, France, suburb of Paris, to build its 1-in., 6-spindle TS Conomatic adjustable camming lathes. Renault, in turn, has granted to Forges de Vulcain, Paris, selling rights for these machines in France and the French Commonwealth. In addition to being one of Europe's major auto makers, Renault has built for many years special machine tools for the commercial market.

Four shows in Europe...

Four machine tool shows are scheduled for this year in Europe. The every-four-years' International Machine Tool Exhibition will be staged at Olympia in London June 25 to July 8 by the Machine Tool Trades Association of Great Britain.

The German machine tool industry is planning a Machine Tool Show at Hanover next September 11 to 20. It will be sponsored by the German Machine Tool Builders' Association.

The Italian Biennial Machine Tool Exhibition is to be held in the Milan Fair Zone October 7 to 16 under the auspices of the Italian Machine Tool Builders' Association. (UCIMU).

French machine tool builders will put on a show at the modernistic CNIT exposition center in Paris September 9 to 18. It will be the first of a series that will be held every two years.

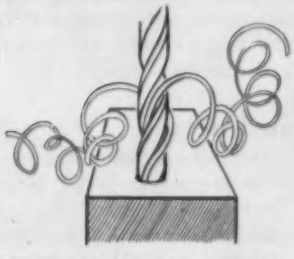
CLIP AND FILE

DRILLING TIPS YOU CAN USE

WEB THINNING IS IMPORTANT

The failure to thin the web is a common error in drill repointing. Most drills are made with webs that increase in thickness towards the shank. As the web increases, the length of the chisel edge will also increase if not thinned. Always thin the web to its original thickness, using a machine whenever possible.

NEED A CHIP BREAKER?



There is a solution to the nuisance and danger of long stringy chips — a common problem in deep hole drilling. It is Chicago-Latrobe's "LO-TORK" Chip Breaker Drill. "LO-TORK" Drills have a radically new flute contour that breaks chips, permits faster feeds, improves lubrication, and lengthens tool life.

GOT A DRILLING PROBLEM?

Arrange a consultation with a Chicago-Latrobe Sales or Service Engineer. His experience in hundreds of plants can lead to a quick solution of your problem.

Best tip of all...

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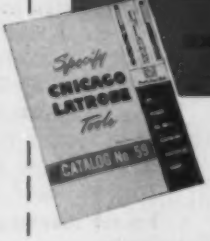
COUNTERSINKS • COUNTERBORES
CARBIDE TOOLS • SPECIAL TOOLS and
exclusive "LO-TORK" CHIP BREAKER DRILLS



Write Chicago-Latrobe or call your distributor for CATALOG No. 59. Sixty-eight pages of illustrated listings and information — including prices.

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MATERIALS...

The outlook for glass . . .

Imagine, in a few years, drawing the "blinds" in your home by flicking a switch which causes all of your transparent windows to become opaque. Imagine cooling the room by pressing another button to make the window-glass porous, admitting draught-, insect-, and rain-free outside air. Just a couple of the things you can anticipate—current glass research and development offers some startling techniques.

Increasing strengths of glass materials will move them into greater roles as load-bearing members. This strength plus a continually expanding range of colors, economically manufactured by new processes, together with new fabricating and forming methods, will accelerate the use of glass as a manufacturing material. Similarly, glazing will become more of a pre-fabrication task, by a structural-component manufacturer, than an on-the-job installation. Uses of heat-treated glass, such as the tempered glass used in some automobile rear and side windows, will find wider acceptance as processes are improved.

Glass fibers, colored if desired, will provide window and door screens as well as insulation. Fibers, of course, will play an increasingly important role as reinforcement for resins. Microporous foam will surround buildings, and appliances, with a vacuum blanket that offers a new high in insulation efficiency.

Glass will focus the energy of the sun onto thermoelectric converters for compressors which will cool one-fourth of 1970's new homes. As the rising sun's heat increases, the energy available to cool the buildings also increases.

Dr James E. Archer, Director of Research, Pittsburgh Plate Glass Co, says, "Variable transmission glass; electroluminescent glass; electrically conducting glass; microporous glass with adjustable resistance to air flow; vacuum insulation blankets; fibers, foams, and foamed fibers; solar energy collectors; new shapes, colors, and decorative finishes; malleable glass of steel-like strength—all of these and many more, plus products not yet foreseen, offer a far greater variety of new possibilities and combinations than have been created in the last century."

High-vacuum pump . . .

Capable of creating a "dry" vacuum in the pressure range from 10^{-4} to 10^{-8} mm of mercury (10^{-1} to 10^{-5} micron Hg), the Evapor-ion pump operates without organic pump fluids. Manufactured by Consolidated Vacuum Corp, Rochester, N Y, the unique electronic "pump" does not require mechanical pump forepressure for continuous operation. Typical pumping speeds are 1900 liters per sec for nitrogen, 1000 liters per sec for oxygen and 3000 per sec for hydrogen.

Gas molecules are not "pumped" so much as captured inside the pump by chemical reaction with metallic titanium or, for chemically inert gases, by ion entrapment. Titanium wire is fed onto a Fansteel Tantaloy post which is heated to 4500 F by electron bombardment from a tungsten filament.

Evaporated titanium condenses as a thin layer on the cooled pump wall. Gas molecules wander into the pump from the vacuum chamber, move aimlessly about, eventually strike the titanium layer and combine with it chemically to form a stable compound. Inert molecules are ionized by electrons emitted from the filament and the ions, repulsed by the accelerator grid, are driven into the titanium layer, where they are trapped by subsequent titanium evaporation.

Suitable for systems which have comparatively long cycles (Pump will operate for six months or longer without breaking vacuum or servicing), the pump is applicable to metallurgy, electronics, metallizing, electron beam and other vacuum processes.

Scovill to broaden in aluminum . . .

For many years Scovill Manufacturing Co, Waterbury, Conn, has been marketing aluminum sheet which it rerolled from semi-processed material purchased from prime producers of aluminum. Development work over the last two years has perfected a continuous-casting process that will permit Scovill to integrate production of the more common aluminum alloys from melting basic metal to rolling finished sheet.

Stainless replaces ceramic . . .

A new gas heater that uses stainless steel as the radiant panel is being made by the Dearborn Stove Company of Dallas, Texas. The type 310, 22-gage stainless steel in the new clip-on heater is supplied by Allegheny Ludlum Steel Corporation to Toepfer & Sons, Inc, of Milwaukee, Wisconsin, who perforate the metal with 206 holes. It is 1 9/16 inches wide and about 12 inches long. The stainless actually acts as a flame baffle. In most heaters this section is made of ceramics.

Press the button, that's all! The Ajax Magnethermic Billet Heater delivers a billet at exact temperature to the extrusion or forging press.

THE NEW NAME WITH THE FAMILIAR RING!

60 Cycle Induction Billet Heaters manufactured by AM... one of our many products for induction heating or melting of all types of metals.

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WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking Production Index now on 1957 base...

Starting with this issue we are shifting our Metalworking Production Index to the base year 1957, and are using new weighting factors to calculate the values of the five components that make up the Index.

These statistical refinements, reflecting changes in the economy over the past decade, will make the Index a more accurate and sensitive indicator of metalworking production. A full analysis of the Index—how it is compiled, the relative weightings of the components, and a graphical presentation of how it has fared over the period 1939-1960—will be presented next issue.

Capital spending to rise...

Capital spending by industry will rise to $37 billion in 1960, according to the SEC-Commerce Dept survey (see page 124). And metalworking, all phases of it, should show healthy gains.

The electrical machinery industry, according to the survey, will show an increase in capital spending of 43% over 1959, and this level will represent an increase of 24% over the previous all-time high.

Latest reports from the steel producers indicate that the operating rate will be at about 85% during the second quarter, with actual consumption at a rate of 75 to 80%. The adjustment has come a little sooner than most people expected, but the outlook is still for a good year.

Tool and die manufacturers in Midwest report high rate of business at the moment but are not making any predictions on second-half volume. The NTDMA, at its Winter Meeting, forecast good business for the remainder of 1960. It noted that most of the new tooling is going into defense, automotive, appliances, electronics, and business machines.

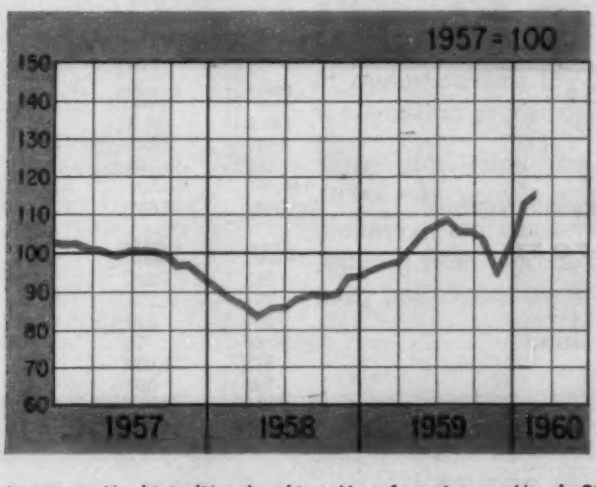
Materials handling equipment manufacturers feel this could be one of their best years, if not a record one. They cite increased inquiries, reports of increased capital spending, and action on deferred modernization plans throughout industry. Latest estimate is for orders to be about 12 to 15% over 1959.

Midwestern foundries are running at about 70% of normal, with the outlook for the balance of the year mixed. Replacements for machine-tool castings form a big part of current orders. A good year is forecast, but some companies are still looking for proof of it.

The appliance picture is mixed. Some manufacturers report sales are off slightly (one as much as 10%); others report gains of as much as 7%. One steel mill, however, points out that orders from appliance manufacturers are off 20-25%.

American Gear Manufacturers Association's latest monthly report shows an increase of 4.1% in new bookings, but a considerable drop in shipments.

Automotive parts manufacturers in the Cleveland area are adjusting their forecast to Detroit's latest estimates of auto production. As is the case in many industries at the moment, the outlook for the quarter is good but predictions for the rest of the year are scarce. At least one major producer has felt the effect of cutbacks from Detroit, but the firm feels the current auto slowdown is temporary.

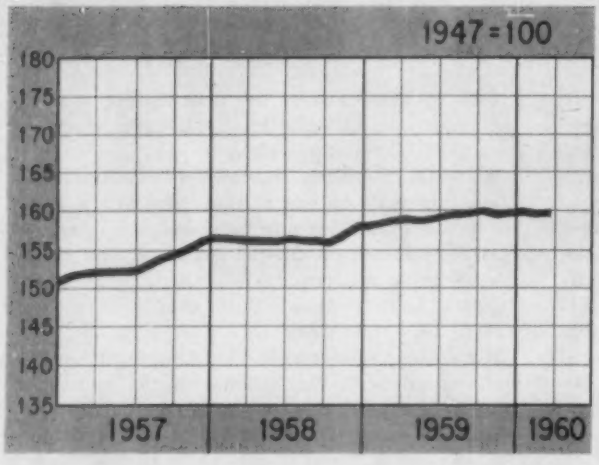


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	Feb. '60 Estimated	Jan. '60 Preliminary	Dec. '59 Revised	Jan. '59 Year Ago
Total Index	**114**	**112**	**103**	**95**
Machinery		106	104	87
Electrical Machinery		118	116	99
Vehicles, parts		125	94	97
Other Transportation		89	91	94
Other Metalworking .		112	107	100

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	FEB. Estimated	JAN. Preliminary	DEC. Revised	JAN. Year Ago
Total Index	**159.8**	**159.7**	**159.6**	**158.2**
Metalworking Machinery	**189.7**	**189.7**	**182.4**	
Other Machinery exc. Electrical	**172.4**	**172.3**	**169.3**	
Electrical Machinery	**162.3**	**162.1**	**158.9**	
Fabricated Metal Products	**148.1**	**148.1**	**148.6**	

A fresh look at inventories...

Business inventories have grown substantially in recent weeks. In January alone, businessmen added $1 billion worth of goods to their stocks. Despite this buildup, there is still no indication that stocks have grown out of proportion to requirements on the whole.

Take, for example, the ratio of inventories to sales—a usual gauge of inventory needs. The ratio of inventories to sales in manufacturing (where stocks have grown most rapidly) is still below the level of a year ago, and also below the average level for the boom months during 1956-57. There is thus little reason to fear a business downturn set off by stock liquidation.

Actually, a big surge in inventory building was expected for the early months of this year, based on the assumption that steel users would be rushing to rebuild their depleted stocks. But the type of surge expected has not materialized. A large part of the current inventory buildup is the result of sluggish auto sales. Auto makers and dealers are piling up finished products—a development they hadn't counted upon.

But the growth of inventories in this area is certain to ease as production schedules are brought in line with sales. And there is no indication that businessmen in other sections will rush to build inventories in the months ahead The quick rebound in steel production eased many fears about the possibility of shortages. And there is ample capacity in other industries to guarantee against shortages. Thus the pace of inventory building should ease in the future.

The absence of general inventory building has also meant the absence of new pressures in the money market. Credit is not now as scarce as had been expected. That's one reason why construction activity has been holding up so well this year. Because builders have been able to find mortgage money, housing starts have held well above predicted levels. It's this type of solid activity that will keep business growing.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	157.9	159.3	151.3
Steel ingot production (thousand tons)	2,647	2,645	2,604
Electric power output (million Kilowatt hours)	14,262	14,092	12,945
Production of automobiles	140,650	153,501	133,540
Engineering construction awards (Eng. News-Record, millions)	284,484	505,637	372,119

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	283	266	287
Vacuum cleaners sales (thousands of units)	294	290	370
Washers sales (thousands of units)	264	313	331
Household electric ranges sales (thousands of units)	80	73	84
Radio production (thousands of units)	972	1,055	1,526
Television production (thousands of units)	593	561	415
Gear sales index (1947-49=100)	233.9	208.7	145.5
Foundry equipment new orders index (shipments, 1947-49=100)	95.9	131.2	137.0

*Seasonally adjusted

IT'S FASTER...

IT'S A BIG IMPROVEMENT...

IT'S A MONEY MAKER!

These are exact words from the production officials of The Cleveland Worm and Gear Company, of Cleveland, Ohio, which company produces the universally known and widely used Cleveland Worm Gear Speed Reducers.

The machine to which they refer is their new "AMERICAN" DeLuxe Model Hydraulic Duplicating Lathe. This lathe, as the illustration shows, is used primarily for machining worm forgings from a round template.

Accurate duplication of parts, high speeds, heavy cuts, plenty of power, quick acting air operated tailstock and ease of operation are the major characteristics contributing to the amazing productivity of this machine.

More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, The Cleveland Worm and Gear Company has found this to be true.

Bulletin No. 135 gives a complete description and shows many examples. It's yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 248 READER SERVICE CARD

Armco "Ads" are not Born in Ivory Towers

Because of the many "ads" you see in the many magazines you read, we thought you might like to see how an advertisement is prepared at Armco Steel.

The men who write Armco advertisements are not skygazers. They get specific information from many sources. It comes from customers; from Armco salesmen, and from marketing and product specialists.

After an Armco advertisement is written, it must pass a "screening test." Depending on the subject matter, from five to fourteen specialists are required to review and approve the advertisement before it is released. Last on the list are Armco Research Engineers—the most critical of all.

1. Writer in Armco's own advertising department probes for information with an Armco market specialist. When possible they use a factual account of a customer's experience with one of Armco's special steels.

2. Next, writer confers with a product specialist —a person who keeps in touch with the technical aspects of a specific grade of steel. There, he gets a refresher-course on the properties of the grade . . .

3. . . . or writer may visit a customer for the information he needs. More often than not, he departs with a note pad full of information—facts about the performance of the steel in a finished product.

4. Back with his typewriter, the copy man goes to work. His ideas and the facts he has gathered are ready to jell. If all goes well, he may write an "ad" in a few hours; others, more complicated, may take much longer.

5. When satisfied with his effort, writer has script typed and gives the text to Armco's art director for layout. Supplies pictures—often gets better ideas for illustration from head of staff or one of his artists.

6. "Ad" O.K.? Far from it—it's just ready to "run the gauntlet." Research man is one of many reviewers required to check copy and layout, correct where necessary, and initial approval. Only then, "O.K. for Publication. . . ."

New steels are born at Armco

This isn't the easiest way to "get out an ad," but we're sure it's the best way to give you helpful information you can rely on. Armco Steel Corporation, Middletown, Ohio.

ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Shops That Are Essential

The small metalworking shop is a hardy institution. Its woes are more often publicized than its successes. Seldom is it studied objectively.

But that is what Professors William Kinnard Jr. and Zenon Malinowski of the University of Connecticut's Business School have done. They have concentrated on metalworking's 22,000 satellite shops, with interviews-in-depth in the New Haven-Hartford area.

They have come up with a recital both melancholy and heartening. Their main findings are reported in this issue beginning on page 118.

Satellite shops, clustered around a major manufacturer like Pratt & Whitney Aircraft, often are owned and run by one or two technicians or production men with little or no management experience or skill, the study reveals. These shops often are financially shaky, use irregular accounting methods, have a skilled labor shortage, are preoccupied with short runs.

They have too few customers, are undermanaged, are tied too frequently to the business volume of a feast-or-famine parent industry. Their profits are high and their losses deep. Their products are custom-built.

The risks are so perilous . . .

that these shops find it hard to attract solid financial help. What's more, the owners almost would rather go broke than accept financial aid even slightly impinging on their freedom to make decisions and to own the business outright.

Everything fortunately is not negative. Satellite shops possess certain virtues—low overhead, high quality performance, intimate knowledge of the industries they serve, a flexibility impossible in a big company, and ability to make quick decisions.

Considered collectively, satellite shops are essential to the successful working of our national economy and to defense production. Their degree of efficiency can make or break production bottlenecks. Our mammoth plants would have rough going without them.

Professors Kinnard and Malinowski content themselves with a recital of facts. They make no recommendations. Their study, nevertheless, lends support to certain observations.

So long as free enterprise exists, we shall have individualists who want to own and operate their own businesses. Some will be successful, but the mortality will be very high. The venture is not for the faint-hearted.

While we wish success . . .

to this small army of small businesses, we see no reason why they should be subsidized by taxpayers. The government should confine its aid to seeing that they are protected against unfair competition and to trying to help the owners to manage their businesses better. Beyond that, they must stand or fall on their own.

Elton T Barrett, president of CGS Laboratories Inc, owner of a small business in Stamford, Conn, expressed our feeling in an article in this magazine two years ago. He said that small business does not need, want or expect special consideration from anyone.

He further stated that small business is not a delicate organism, that it is a hardy institution capable of such quick adaptation to new situations that it would be hard to stamp it out. As long as it renders a service to someone else and is run by hard, loyal, intelligent, capable men who are instantly sensitive to changing conditions, it will flourish.

Burnham Finney EDITOR

XLO EX-CELL-O FOR PRECISION

C

A

D

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
D. DB 50 Motorized Quill-Type Spindle
E. DB 22 Square Body Spindle
F. Standard DB 22 Spindle

E

57-90

Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

For complete information, why not get in touch with your local Ex-Cell-O representative or, if you prefer, send direct for bulletin 25477.

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CIRCLE 250 READER SERVICE CARD

really REALLY
Clean for missile parts

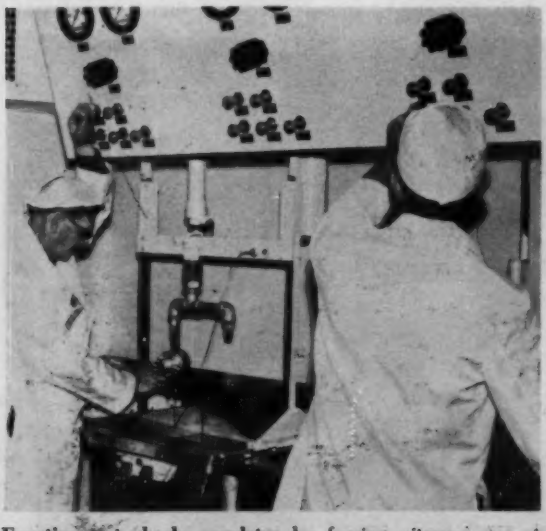
Two kinds of payoff mark the success of a $30,000 investment in a special "clean room" by Victor Equipment Co, San Francisco. One is greater bidding power on defense contracts; the other is new possibilities for commercial-product work, in both cases on parts that require high cleanliness.

The room was built in the Victor plant by Moore & Hanks, El Monte, Calif, for cleaning, assembly, test, and packaging of high-pressure gas-regulator valves for missile ground support. It is 25 x 40 ft of separate prefabricated chamber with its own temperature (70-72 F), humidity (40-50%), and pressure control (slightly over normal to make any dust leak out, not in). The air-conditioning system filters incoming air to exclude 90% of all particles larger than 5 microns, and to changes 20% of the air each 20 minutes by draftless blower.

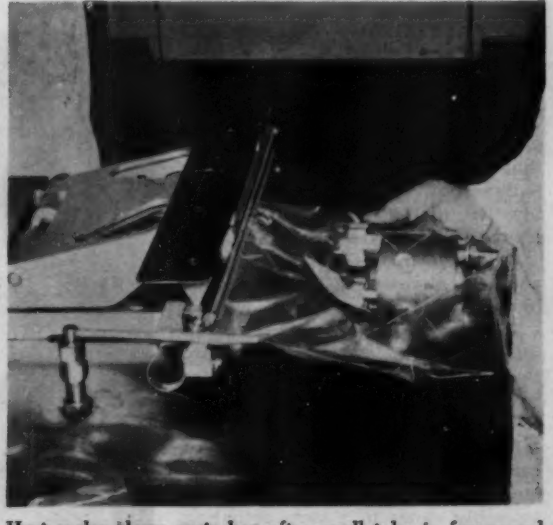
Entry is through two antechambers (three doors) divided for

Parts enter the clean room through air lock. Only one window can be raised at one time. Tote pan is plated; identity tags are plastic-coated to resist dust

Glittering vise holds a regulator being assembled to a dome. Nylon gloves are missing here because operator's hands will not touch the work



Function test checks regulator by forcing nitrogen gas at high temperature through system. Output pressure is checked against input to show up leaks or bad calibration



Heat sealer closes parts bag after small tube in foreground removes excess air. Operator heat-seals open end around tube, then shifts bag to seal remaining opening

changing into nylon smocks and caps (no lint) in the first chamber, and an "air shower" that blows away residual lint and dust in the second. The blower operates only when the second door is closed, and stays on for 15 seconds until an automatic control shuts off the air and releases a latch that allows entry into the clean room proper.

Cleaning sequence

Parts go in through two air locks. A filtered solution of Oakite 61A in a Narda ultrasonic cleaner removes foreign particles, then a hot (140 F) blast of dry nitrogen dries the parts. Vapor degreasing with trichlorethylene follows, with another drying stage with hot nitrogen gas. Final inspection is under ultraviolet light, which shows up any remaining grease particles. A second degreasing removes these, if present.

Workers wear nylon gloves at all times, use chrome-plated tweezers to get into close quarters, then assemble the valves at stainless-clad work benches. Vises and tools are all chrome plated, and tote pans are cadmium plated for easy cleaning.

Functional test equipment checks out completed assemblies with filtered water and bubble-leak tests. Hot nitrogen again dries the parts.

The high-pressure regulators leave the clean room in plastic bags, from which much of the air is pumped out by vacuum cleaner, after which the bags are hermetically sealed.

Missile primes like setup

Fred Stettner, vice president for engineering and production at Victor, says the facility has been certified by Convair and Douglas, and other prime contractors are expected to stamp their approval shortly. He says, "We feel the investment is justified because we are turning out better products as well as participating in the defense program."

Ultra-violet test discovers specks that are invisible to the naked eye. Each piece is checked individually after washing, before assembly starts

Dialed instructions single out missile gyros for test

By Robert Woodward
chief manufacturing engineer—assembly
Raytheon Co, Andover, Mass

Nothing must interfere with the rate of spin of the gyro of a Hawk missile—and that rate reaches 36,000 rpm within seconds after start.

The tiny heart of the gyro is the motor wheel assembly, and it must test out perfectly if the desired rate of spin is to be achieved. Formerly, if bearings were too tight or too loose, the sound (pitch) caused by the spinning gyro wheels indicated that something was wrong. Adjustments were made with hand tools.

But now, Raytheon engineers have come up with test equipment (see photograph at right and front cover) that not only determines tightness or looseness of a motor wheel assembly, but makes adjustments by the simple turning of a knob.

Not only that, the new machine automatically tests 84 wheel assemblies at once. It works this way:

Twelve trays, each holding seven assemblies, are loaded in pairs into the console. When the assemblies have completed a 12-hour test run, the machine stops.

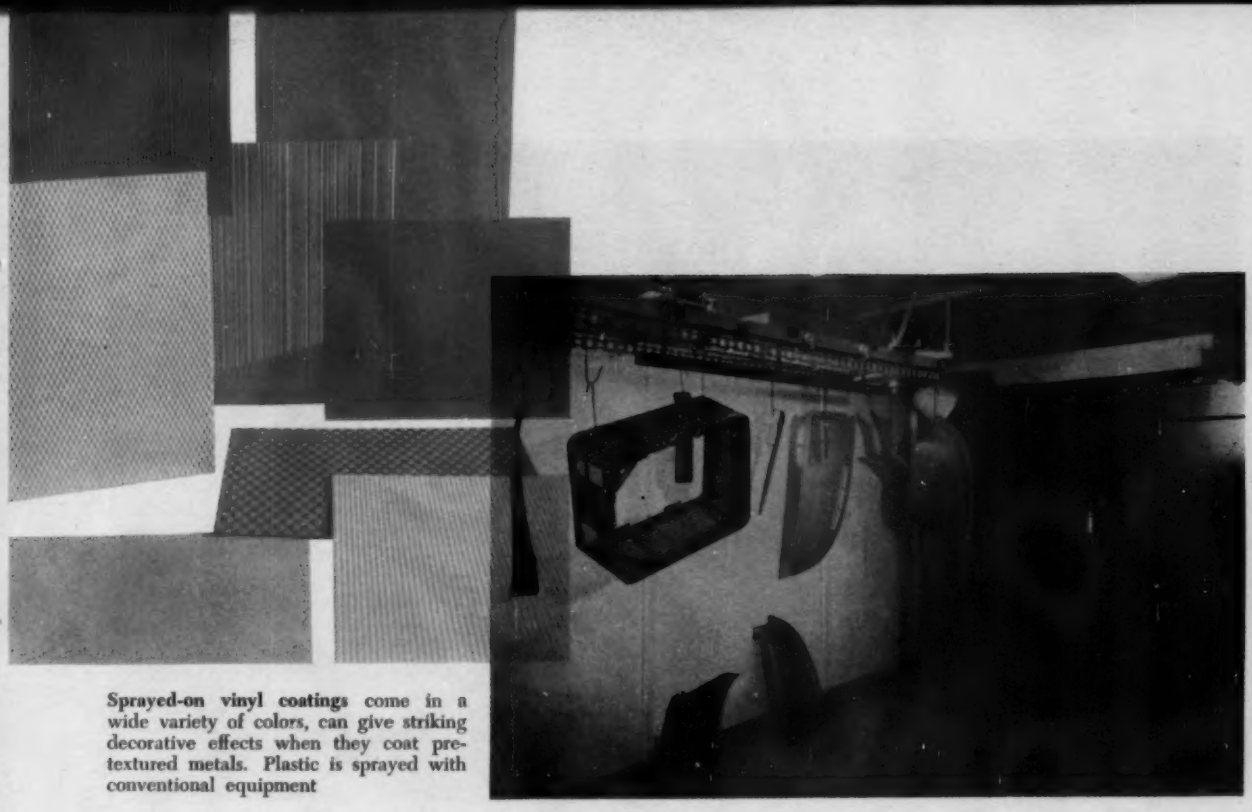
Every two hours, the coast time of each assembly is automatically measured. If there is trouble, the assembly slows to a stop, actuating a light that indicates whether the bearing is tight or loose. Operator then makes the correction by turning a knob to tighten or loosen the bearing adjustment nut.

Then to find out if his knob adjustment is right, the operator dials the number of that particular station—putting only that motor into a retest circuit. If by chance the operator mistakenly dials the station of a motor that is running OK, a warning lamp lights, and the motor is not affected. To correct such a mistake, the operator simply pushes a reset button and dials the right number. Meanwhile, testing of the other assemblies goes on uninterruptedly.

The Raytheon-designed test console is built into a modified, air-conditioned Baker bench, and is wired to a separate control console designed for these tests.

Raytheon's new test routine, while still a simple mechanical check on gyro bearing loads, affords an excellent opportunity to correct yaw, pitch and roll aberrations before the missile becomes flight operational.

Telephone dial singles out gyro unit for special test



Sprayed-on vinyl coatings come in a wide variety of colors, can give striking decorative effects when they coat pre-textured metals. Plastic is sprayed with conventional equipment

Decorative finishes with plastic spray

Sprayed-on vinyl coatings for plain or textured metal—that's the latest development in decorative finishing of steel and aluminum. With conventional spray equipment, a fabricator can deposit the tough corrosion- and chemical-resistant plastic on his product in just about any color.

Bonding the plastic to metal is relatively simple. The user applies—in his shop—a primer to the steel or aluminum, sprays on the vinyl, then bakes it at 350 to 420 F for a short time. Normal thickness for decorative coatings is about 4 mils.

The new spray technique joins two other vinyl-on-metal systems that produced an estimated 30-million square feet of product last year. In one system, vinyl film is laminated to metal sheet. In the other, a vinyl coating is roller-applied continuously to steel strip.

Advantages of spray

Developers of the spray system, Metal & Thermit Corp, claim several advantages:

- A manufacturer can coat his metal product *after* he makes it, instead of assembling parts that have been precoated with plastic. Thus there are no raw or unfinished edges, and welds are hidden.
- The spray system can deposit an even coat of vinyl on uneven surfaces.
- Rejects can be stripped of their vinyl finish chemically and then re-sprayed.
- Scrap metal is uncoated, retains its value. No vinyl is wasted.
- To change color, the user merely changes paint cans; large inventories of precoated stock in various colors are unnecessary. Thus production scheduling is simplified.

Applications

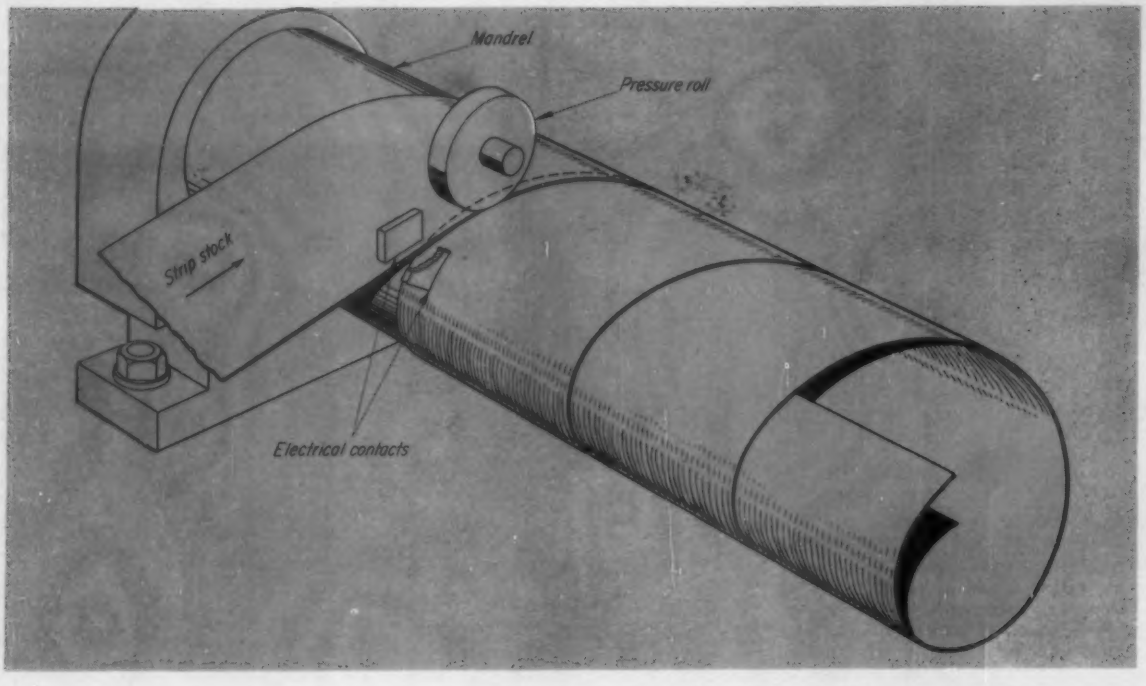
Almost any consumer or industrial product that requires a decorative finish could benefit from the spray technique. One early user: General Electric, at its Appliance Park plant, is spray-coating the insides of dishwashers. Other applications include office machines, automotive-interior accessories, radio and TV cabinets, and appliances of all types.

Pre-textured metal, available from several sources in the steel and aluminum industries, can be vinyl-sprayed to give striking decorative effects. In the steel or aluminum mill, patterns (such as diamonds, squares, or wrinkles that simulate leather grain) are rolled onto metal sheet; premium for this textured metal ranges from 5 to 20% above the cost of plain metal.

Costs

Developer of the spray system claims that costs are competitive with those of precoated metal. An average figure for a 5-mil coat of spray-applied organosol vinyl on a 1-ft-sq panel is 14¢ in volume production. For 12 mils of spray-applied plastisol, cost is estimated at 12¢. (These costs do not, of course, include cost of the metal to which the coating is bonded.)

Spray product, in both organosol and plastisol form, is produced by M & T at its Carteret, NJ plant, goes out to consumers in 55-gal drums or 5-gal pails. Here vinyl resin, received from suppliers in powdered form, is treated with solvents, pigments, stabilizers, and plasticizer to give the final product: a liquid in which the resin is dispersed but not dissolved. Spraying this liquid on metal, then baking it, causes a dissolving of the vinyl resin that creates a continuous plastic film on the metal.



High-frequency current flowing between contacts and bottom of V heats joint edges to welding temperature

Spiral mill welds variety of tubing

Flexibility, versatility, and speed are the main claims of this small tube mill and high-frequency welder. It can spit out 3-in. tubing (0.009-in. wall thickness) at 150 fpm, and it can handle material thicknesses ranging from 0.004 to ⅜ in.

Good results have been obtained with both ferrous and non-ferrous metals, including aluminum, copper, and some of the rarer metals like Zircaloy, according to the developer, New Rochelle Thermatool Corp.

And there's no need for special cleaning before welding. The high-frequency technique welds right through surface films and oxides. In operation, a monitoring device senses any malfunction and shuts off both the mill and the welder.

Announced only last year (*AM*—Mar 23 '59, p3), the spiral mill already boasts a number of applications, either in operation or planned—air conditioning ducts and down spouts, automotive components such as filters and exhaust pipes, field applications such as irrigation pipe and piling forms, and a variety of other tubular products.

The tube is produced in a round section, of course, but it can be formed to any desired shape by running it through a turk's head. The process can weld perforated material as well as plain stock.

A significant advantage of the mill is the short setup time required for changing from one size of tubing to another. In a matter of minutes the operator can change the mandrel and adjust the angle at which strip stock is fed into the machine.

Sizes range from 1½ in. to 6⅝ in. on the unit shown above. The 1½-in. diameter is minimum at present because of the mandrel required for mashed lap welds, but the maximum size is practically unlimited.

The New Rochelle, NY, company makes only the smaller tube mills but claims that its basic welding technique and power-supply unit are suitable to almost any tube mill on the market.

Another advantage is the small space needed for the equipment—compared with conventional straight tube mills running 40 or more feet in length. A spiral mill capable of producing 6⅝-in. tubing occupies only 6 x 8 ft, plus another 3 x 7 ft for the power supply. The 2000- to 3000-ft coils of strip stock used as raw material also take up a minimum of space.

The welding principles involved are the same as those employed in other high-speed welding equipment produced by the company and marketed under the name Thermatool. The main feature is the very high frequency current—450,000 cps—which is introduced into the metal by means of sliding contacts.

When strip stock is drawn into the mill and through the forming rolls, the two edges to be welded come together in an elongated V. An inch or two before the bottom of the V, two sliding contacts, one on each side of the V, introduce the 450,000-cps current into the metal.

Electricity at this high frequency has a special characteristic that is put to good use in the welding process. Instead of following the path of least resistance the way 60-cycle current does, it follows the path of least inductance, *whether or not* it's the path of least resistance.

Normally, the low-inductance path is the path closest to the return conductor of the circuit. In this process, each of the two edges coming together in the V acts as the return conductor for the other.

Therefore, the edges are the low-inductance path. This puts almost

all the current—and the heating effect—along the edges of the metal where it will do the most good.

At any instant, during a butt weld for example, the current is traveling from one contact, along the face of the joint to the bottom of the V, and then back along the other face to the other contact. Thus, the metal is being heated along both edges from the time it passes the sliding contacts until the pressure is applied at the bottom of the V to produce a forged weld.

Obviously, the V is important, and so is the continuous feed past the contacts. The process cannot make a stationary weld such as a spot-weld, but it makes seam or edge welds at high speed on any parts that can be brought together in the proper manner.

The spiral welder can make a butt weld, lap weld, or mashed lap weld, as desired. For thin-walled tubing, the mashed lap weld is the most effective and causes only a slight difference in wall thickness at the weld. Heavier tube calls for lap or butt welding.

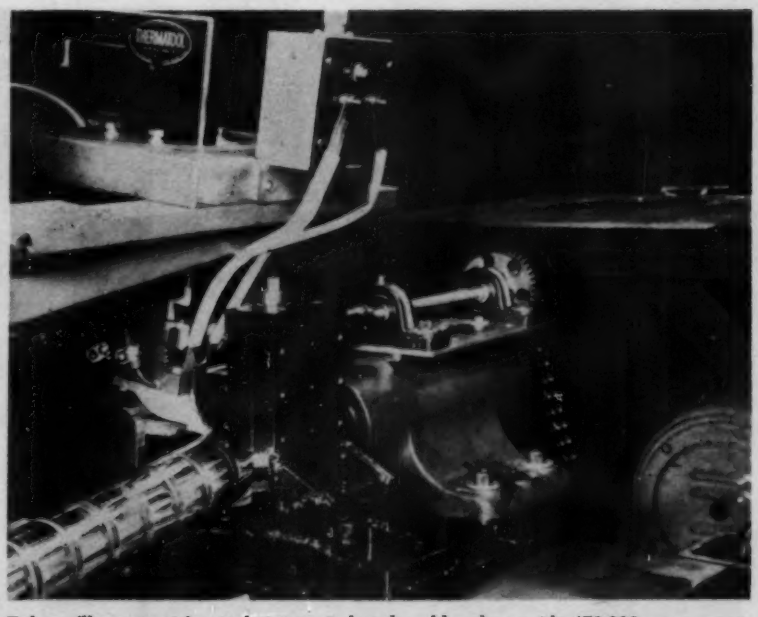
In either case, the spiral weld adds to the stiffness of the tube and often permits a lighter gage material than would be required for longitudinally welded tube. The more spirals per unit of length, the greater the stiffness.

On the other hand, the greater number of spirals means a longer welding path and more process time per foot of tube produced. The optimum arrangement will depend, of course, on the individual application.

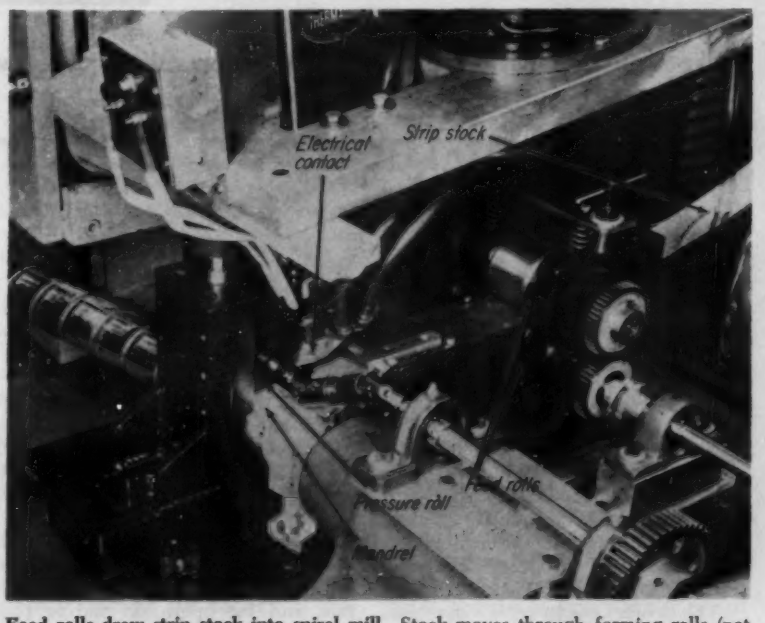
Normally, the width of the strip equals the diameter of the tube to be produced. With this ratio, the weld length is about three times the length of tube produced. However, in spite of this, production rates are high because of the speed of the welding technique.

Actually, it is the mill rather than the welder that limits the production rate. In material thicknesses ranging from 0.010 to 0.109 in., the mill can wrap 250 ft of strip per minute, and the welder can match this easily. Therefore, the normal production rate is one-third of 250 fpm or about 80 ft of tubing per min.

The basic equipment for the process consists of the spiral tube mill, the high-frequency power supply, and a cooling-water supply for the power unit. Accessories should include a run-out table and a flying cutoff for high-speed operation.



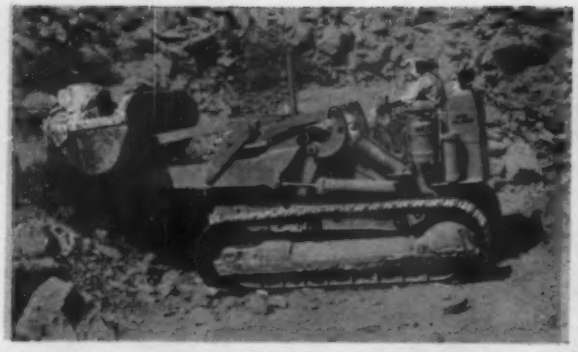
Tube mill wraps strip stock into spiral and welds edges with 450,000-cps current. Tubing emerges horizontally but at an angle equal to helix angle



Feed rolls draw strip stock into spiral mill. Stock moves through forming rolls (not visible here), past sliding electrical contacts, and over mandrel where pressure roll finishes the mashed lap weld

The normal power supply is a Thermatool vacuum-tube unit that operates from a 3-phase line and converts 60-cycle power into the 450,000-cycle power needed. A 25-kw unit, drawing 60 kva, will handle steel and stainless steel, but aluminum, copper, and some of the rarer metals require a 60-kw unit. A motor-generator unit is also available for portable (truck-mounted) applications.

Maintenance is said to impose no special problems. The sliding contacts are good for at least 100,000 ft of weld before they have to be replaced, and an operator can exchange contacts in 5 or 6 minutes. Electrical maintenance can be handled by most plant engineers.



Product, problem, and solution: Caterpillar had to double output of 4- and 6-cylinder engine blocks for the diesel tractor shown above. Both were to be machined on the same line, using as much existing equipment as possible and, of course, as cheaply as possible. It took Caterpillar five years to evolve the perfect solution, "progressive production," a combination of job lot output and mass production. Heart of the unique line is four multiple-spindle Natco drilling machines (photos at right), which perform a variety of drilling and tapping operations. Only one operator is required

Strike a balance between mass production and low volume job lots with . . .

Middle-of-the-road automation

By Charles E Lipp, tooling manager
Caterpillar Tractor Co, Peoria, Ill

Mass production is one thing: low-volume job lot output is something else again. Supposing a large part of your firm's production falls somewhere between the two?

It has taken Caterpillar five years to strike a delicate balance between the two methods. The end result, now taking shape and partially in operation, is a unique machining line embodying the Caterpillar-created concept of "progressive production."

The project began with a question, "What has to be done to produce X number of pieces per hour most efficiently?" X in this case represented yearly production in five figures, and an immediate 100% increase in output. The pieces were to be four- and six-cylinder diesel engine blocks, to be machined on the same equipment.

Uses existing equipment

Added complications: the production area available was strictly limited, Caterpillar could tolerate a lead time of only six months from the day it let contracts, and the company wanted to use as much existing equipment as possible.

Then, too, any system to be devised had to have potential for a big production increase, and it had to be adjustable for engine block model changes with only minor revisions in tooling.

Of course, all this had to be done at minimum expense, with definite cost advantages over earlier methods, and the operation had to produce a reasonable return on investment—quite an order.

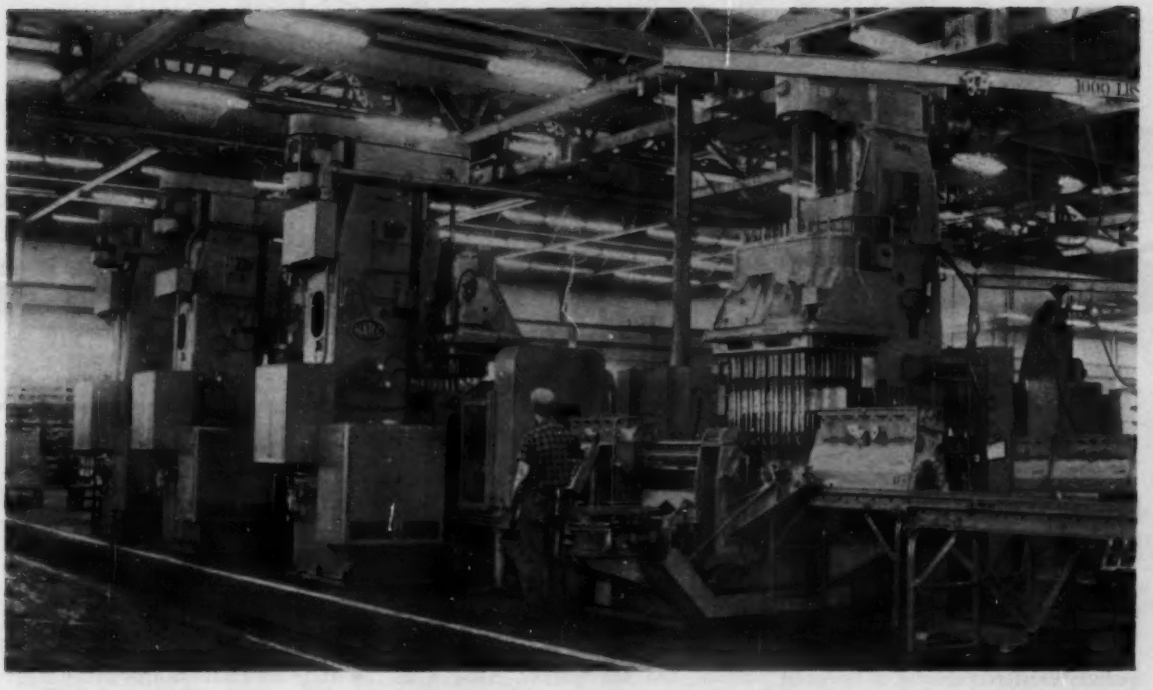
The line that evolved after five years of planning includes some 30 separate machines tied together (mostly end-for-end) with conventional transfer equipment. All degrees from manual operation to fully automatic are represented both in the transfer equipment and the machining units.

The main criterion: could an operation be most efficiently performed by manual, semi-automatic, or automatic means at the production rate required? Thus, most of the machining stations are fully automatic; much of the straight-line transfer (on roller tables) and straight-line loading is manual; and most of the unloading, rollover, and turnaround operations are either automatic or power-assisted. Power is used for positioning, securing, and releasing parts.

Machines from five builders

The line is laid out in three legs —Z shaped—to fit it into available space and to allow room for in-process banking. Five machine tool builders (including Caterpillar) are represented in the machining stations.

The milling machines are all from Farrel-Birmingham. Ingersol Milling Machine Co, made the precision boring machines. Caterpillar contributed its own Cat-Type deep hole drilling and reaming machines. Multiple-spindle drilling and tapping machines are all Natcos, and Cin-



cinnati-Bickford Division of Giddings & Lewis is represented with three radial drills. In addition there are numerous checking and gaging stations, and a washing machine.

There isn't an unconventional machine in the line (with the possible exception of the Cat-Type specials), but the Natco machines as a group represent a machining approach which is in many respects a "first." For years men have dreamed of tying conventional machine tools together into a single "transfer machine" which would have the production rate potential of single-purpose equipment, plus the change-over versatility of general purpose machines. We at Caterpillar know of no past attempts to do this that have met with success, but we believe we have found a way. Our Natco combination works.

Natco calls it a "convertible transfer line." Our version consists of four standard Natco multiple spindle drilling machines: three two-way machines with horizontal and vertical drilling heads, and one vertical machine. The first two perform drilling operations, the third both drilling and tapping, and the last tapping only.

Each machine is a self-contained unit on its own base, with its own hydraulic pump, coolant, and electrical equipment. Each is tooled with its own loading, locating, clamping, and unloading fixtures. Each machine is linked to the next by transfer mechanisms that automatically convey the part from machine to machine, and perform such orienting jobs as rollover. Differences in working heights are compensated for by spacer blocks and machine adjustments.

Automatic cycling

Machining heads on these Natcos are fully adjustable, with spindle locations determined by slip spindle plates which can be easily changed. Slip plates are equipped with inserts which make spindle relocation even faster. But what really makes the transfer idea feasible are the electrical controls. Each standard Natco is designed for automatic cycling (by itself) so that it takes only the simplest of electrical overrides to control the battery of machines as a unit. The master control panel actually has only five push buttons—and only three are for routine operation: motor start, cycle start, and master stop. The other two buttons (traverse forward all heads and traverse reverse all heads) are included for setup and maintenance purposes.

Each machine also has its own control panel, so that the operator has the option of operating the machines singly or as a four-machine unit. Since each machine is self-contained, any one can be removed from the group and operated independently for other production work. When a machine is removed it can be replaced by a simple conveyor link or another machine.

Production versatility

What this means in terms of production versatility is easy to visualize. If we are running six-cylinder blocks and we want to start running the four-cylinder version, we can change our hole patterns with the loss of only part of a shift. If engineering makes a modification in the hole pattern, we simply order in new slip plate inserts, or rebore the ones we are using in a matter of hours.

The savings inherent in this type of medium production line are great. Linking the Natcos together cost only about 12.5% more than the individual machines (most of the added cost was in transfer equipment), and as a matter of fact, two of the machines in the line were operating in our plant before Natco linked them together.

We figure optimistically that the entire machining line, including the Natco portion, has enough built-in versatility and expansion potential to carry us over 10 years of D-4 and D-6 engine construction. Long before those 10 years are over, we expect other lines of similar philosophy will be operating at Caterpillar.

PROBLEMS

In the United States today are at least 22,000 satellite shops—subcontractors to large manufacturers of a large variety of metalworking products, from aircraft and automobiles to electronic equipment.

Stretched across the nation, frequently clustered around or between the large companies they serve, these shops have many things in common—mostly the problem of survival in a business climate of constantly changing technology, of economic ups and downs, of canceled defense contracts, and of belt-tightening and work pullbacks by the contractors that hire them.

Almost all of these shops are small, employ less than 50 workers. Their owners are mostly technicians or production men, comparatively unskilled in management, yet inclined to look down their noses on those who are.

Yet dependent as they are upon the prosperity, sometimes even the whims of the bigger companies they serve, these same small shops are in the same measure invaluable to their employers. Their collective efficiency or the lack of it can make or break production bottlenecks.

Their economic health, stability and survival is vital to the defense effort of this country, especially in these days of "hot peace."

The problems, economics and operations of the satellite shop are the subject of an extensive study just released by two members of the faculty of the University of Connecticut's School of Business Administration: Dr William N Kinnard, Jr, and Dr Zenon S Malinowski, who based their findings primarily on interviews-in-depth with owners of small metalworking shops.

According to the study, 40% of the nation's metalworking satellite shops are in the East North Central area, followed by 23% in the Middle Atlantic region. By states, Michigan has 14% of the nation's total, California 12%, New York 12%, and Ohio, Illinois, New Jersey, Pennsylvania, and Connecticut have 5 to 10% each.

"The importance of these firms in our economy cannot be measured solely in terms of dollar value," say Drs Kinnard and Malinowski, whose purpose in making the study is "to expose and review the peculiar problems and characteristics of these firms and their owners so that substantial insight can be gained as a base for possible legislative, administrative, and advisory programs."

Many common problems

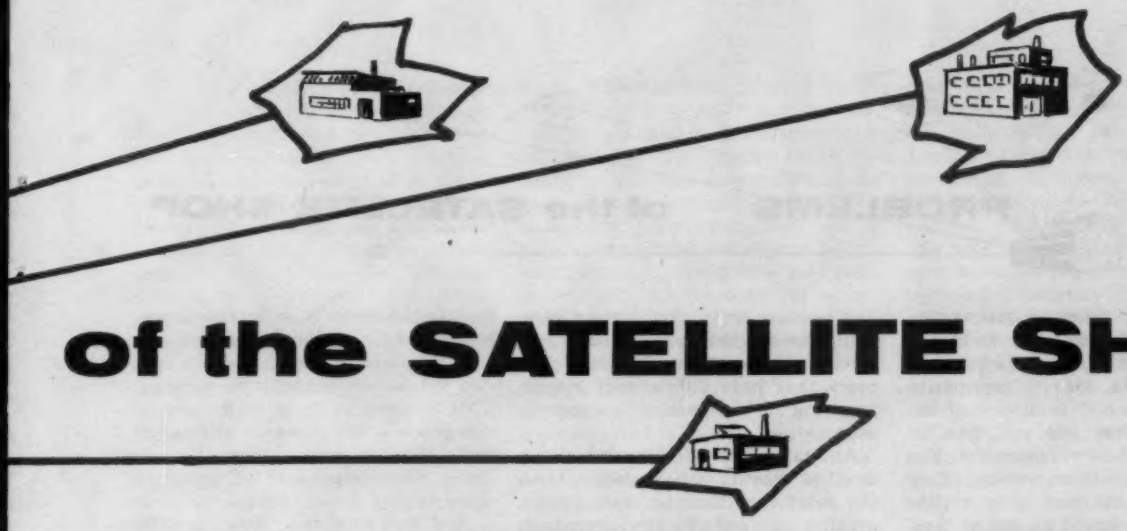
From the interviews, from transcripts of Congressional small business hearings, and survey data from other sources, the authors find that satellite metalworking firms have much in common as a rule:

- **High risk,** resulting primarily from extreme fluctuations in demand and income, a limited number of customers and products, dependence upon one man, undermanagement.
- **Questionable marketability** of shares of ownership—a direct result of high risk factors listed above.
- **Irregular accounting** concepts and practices—stemming in large part from too-close identification of the owner with his firm, and from inadequate records.
- **Preoccupation with short run production,** primarily because of high risk and custom jobbing.
- **Undermanagement** resulting from assumption of all managerial functions by one or two technically [and seldom managerially] trained men.
- **Competitive imperfections** resulting from personal factors, and the differentiation offered by service and quality.
- **Shortage of highly skilled labor** caused in part at least by the volatility of the industry.
- **Intimate relationships** which stem from the importance of service in a customer-oriented market.
- **Inadequate financial arrangements,** especially for long-term funds.
- **High flexibility**—made possible by the smallness of the firm, and by the high technical competence of the owner-founder.
- **Heavy fixed-asset requirements,** coupled with rapid obsolescence of machinery.

As to the owners of such shops, Drs Kinnard and Malinowski find they have a tendency to remain technicians and operators, yet to identify themselves intimately with their business. They make no provisions for disposition of shares of ownership, are conscious of capital gains but do not expand primarily for this purpose, and tend to lack and frequently disparage managerial skills.

Satellite shops include foundries, machine shops, tool and die shops, and makers of small machinery, among others. Many such firms' activities spill over from one such category into another.

These small firms tend to cluster around large centers of production because they must provide fast, reliable service to customers. For instance, it is estimated that more than 350 satellite shops exist entirely on business from United Aircraft's Pratt & Whitney and Hamilton Standard Divisions in the Hartford area. Similarly, General Motors' Rochester Products Division added 26 new sup-



of the SATELLITE SHOP

pliers in the Rochester area just to provide components for a fuel injection unit for the 1957 Chevrolet.

Mortality rate of metals service firms is high for a variety of reasons, notably because they are geared to parent industries that are frequently subject to feast or famine—such as automobiles, aircraft, industrial machinery, machine tools and defense goods. Not only that, the companies for which the satellites work tend to pull back work during bad times.

On the other hand, Kinnard and Malinowski find that when business is good among satellite metalworking companies, it's really good. Profits can be startlingly high in good years: 30 to 40% and even higher after taxes.

Feast or famine

But it's a business of high peaks and deep valleys. For instance, one machine shop owner claims that four years ago he was netting 30 to 40% after taxes, today is operating at a loss. And a tool and jig shop reported profits after taxes as a percent of net sales for 1943 through 1952 as 28, 20, 11, 7, loss, loss, loss, 4.5, 4.8, and 4.1. As a percent of net worth for the same period net profit was 225, 138, 64, 18, loss, loss, loss, 14, 11.2, and 11.4.

And one tool and die manuacturer had 38 employees in November 1956, just four one year later.

Needed: 15% profits

A spokesman for an association of tool and die manufacturers told Kinnard and Malinowski that many of his members claim that if they can't maintain 15% profits as a percentage of sales in good years, they feel they just can not stay in business. Figuring annual sales of a typical 20-employee shop at around $250,000, the shop would have to have a profit of about $37,500 to keep going.

Actually, according to the study, despite years of high profit, the average level of return for satellite metalworking firms is only 4 to 5% of net sales, and 10 to 12% on tangible net worth.

Net profits on net sales for foundries average out at 3.52%, for machine shops 4.76%, and metal stamping shops 3.77%. Net profits on tangible net worth for foundries averages 9.76%, for machine shops 12.20%, and for stamping shops 9.87%. But profits in these categories are highly variable from shop to shop.

Satellite shops slavishly dependent upon one or a few important customers are particularly vulnerable to ups and downs in business of their customers, especially those doing defense contracting. For instance, one machine shop mentioned in the study found its business almost at a complete standstill because the prime contractor it served lost a defense order. This satellite's $100,000 annual sales were entirely to the one prime contractor.

More customers the better

In better shape are those shops that have a half-dozen-or-so important customers. One, for example, that has eight such customers (none with more than 25% of the shop's total business) figures it has eight times the chance of keeping going as the one-customer shop. And it doesn't take outright cancellation of business to hurt a satellite company—delayed payments can do the job, too.

Violent fluctuations in business are one reason why many metals service shops now produce some kind of standardized product as a hedge against ups and downs.

Almost all machine shops in the satellite category do nothing but special jobs for large manufacturers. The machine shops are usually specialists in working or treating certain parts of components, such as cams or gears. Thus the machine shop not only has too few products, it cannot produce them except upon specific orders from the manufacturer. For this reason, satellite shops lean with the business wind of their employer companies.

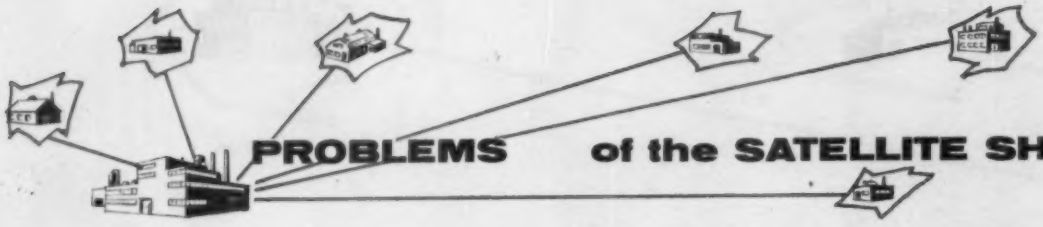
Proprietary products help

Small shop owners interviewed by the University of Connecticut researchers almost to a man said they would like to turn out at least one product that is not custom built, and which differs so greatly in market from their contract work that its sales would remain stable at times when custom business is rocky.

Trouble is, it's hard for a small shop to find and develop such a product, mainly because the shop hasn't the money for R & D, sufficient production capacity, or adequate marketing setups.

Another hazard in the operation of the satellite shop is one that is self-inflicted: too much dependence upon one, or at most two, men. Because the owners of small metalworking shops tend to be technical rather than financial men, poor financial management is the almost inevitable result. From this stems lack of adequate working capital, inadequate sales, overly heavy operating expenses, and competitive weakness.

These are also prime reasons why the marketability of such shops is



PROBLEMS of the SATELLITE SHOP

low. When it comes to selling the shop, the owner frequently finds that buyers take a dim view of a business which depends for its prosperity upon the personal relationship between the owner and one, two, or at most just a few customers. For instance, one of three owners of an experimental machine shop claims that the shop would go out of business if it were not for his ability to get defense subcontracts, and his contacts with purchasing agents.

Some interviewed owners have admitted that the worth of their firms is exactly that of the current market value of the machine tools they own.

A prospective buyer, then, must be willing and able to take the place of the previous owner. In other words, he cannot hope to invest his money and sit at home to reap the rewards. Nor can he expect to be a chairborne executive. Like his predecessor, he must roll up his sleeves and get out into the shop for close personal supervision—and he had better know what he is doing, or lose the shop's customers.

In 1958's recession, satellite shops could only be sold at prices well below the long-run value of the firm. Even capital equipment during a recession can be sold only at bargain prices. However, those shops with a proprietary product have far less difficulty in finding a buyer.

By way of compensation for the ups and downs of business, and for the high risk they take, satellite shop owners are prone, as one interviewed owner put it, "to use a pretty sharp pencil in figuring out expenses for tax purposes." The line of demarcation between the owner's home and the owner's shop is sometimes thin, and all kinds of home expenses can often be charged to the business.

Depreciation practices on machine tools and other capital equipment tend to come perilously close to borderline, too. For instance, one owner said that cash profits to him were profits after purchase of a $30,000 machine tool. Another insisted he writes off machines in one or two years because of rapid obsolescence. And because small shop owners generally do all they can to keep reported profits down for tax purposes, they have difficulty in getting financing or in selling ownership shares.

Another self-created trouble of the satellite shop is preoccupation with the short run. Because most orders involve a one-of-a-kind product, say a prototype or a die, satellite shopmen become preoccupied with day-to-day problems, and find difficulty in thinking beyond the current order.

This is just one of the factors that go to make up the prevalence of undermanagement in such shops—according to Dun & Bradstreet the underlying cause of more than 90% of business failure.

Inadequate business background

Small metalworking shop owners as a rule have an unbalanced background for business — are too far over on the technical and engineering side. They know little of finance, marketing, accounting, personnel relations, purchasing or statistics, yet most owners have to perform all these functions themselves.

Admitted an owner of a small pointer-tubing firm, "Once a firm is successfully started by a competent technician . . . the emphasis for survival shifts to finance."

One suggested solution: let outside lenders and investors aid in management. But this is distasteful to most owners, who jealously guard control of the firm.

The small shop with adequate provision for management succession on the death or retirement of its head is a rare one. Too often, management of a firm passes on to the owner's son, who may or may not have any talent for the job. Either way, this policy is a deterrent in obtaining good second-line managers, who could take over the business if necessary.

"Small metalworking companies are primarily dependent on prime contractors for their very existence," says Arthur J Gleason, vice president of the Southern Connecticut Tool & Die Manufacturing Association. Especially in defense work, small subcontractors must get on the prime's list of bidders before they can get in on competitive bidding. This is often so hard to do that it comprises a firm's whole selling effort. Here is where personal contacts, friendships, and all types of wire-pulling come into play.

And it is here that favors and favoritism are rife. "All purchasing agents have their pets," one interviewed owner said, and wining and dining of purchasing agents, plus "little conversation pieces as gifts" at Christmas are the rule rather than the exception.

Too, prime contractors prefer to deal with one or two established sources. The idea seems to be "once in, you're in."

Of course, the ability of a shop to deliver is of prime importance. All the wining and dining of the right people in the world, won't help the shop that really fouls up a contract. And there is also price competition to consider. Especially in slump times, price is likely to overcome such other considerations as quality and service.

Another problem plaguing the satellite shop is recruiting of skilled labor, and retaining it in bad times. Not only that, many shops have trained men to a high degree of skill, only to have them leave to start up their own shops.

Craftsmen are not coming up from the ranks at the rate in which oldsters are retiring, and a shop finds it difficult to expand without such skilled men.

Worse still, the very customers that a satellite shop serves often lure key men away at wages higher than the small shop can pay. But the small shop that avoids the ruthless layoff practice of big companies in bad times can do much to retain the loyalties of its skilled people.

Service is the dominant product of the satellite metalworking shop. It means close personal contact, and an intimate knowledge of the customer's product, methods, and problems.

Researchers Kinnard and Malinowski, looking into the financial problems of satellite shops, found

that funds are more easily available to those shops with some sort of standardized product for which there is a growing, or at least constant, demand. Specialized custom shops on the other hand find it hard to get money from a bank, and are forced to turn to more expensive credit sources—factors, suppliers and customers—for short-term funds. Large prime contractors in prosperous times frequently will advance the sub money on a contract, provide materials to be processed, even take care of transportation costs.

Generally, though, satellite shops have to take money on short-term loans, in small amounts, and on restrictive repayment requirements. Interest rates on the average rose from 3.4% in 1942 to 6 to 6.5% in 1956, and only a fourth of the loans were given more than a year's repayment period. Too, most of the loans had to be secured by chattel mortgages or similar security, or by co-signers.

Start with owner's savings

When a satellite shop goes into business, most of its capital comes from the personal savings of the owner, perhaps with those of relatives and friends. It is seldom possible to interest outside capital in such a venture. An initial capitalization of only $5000 to $10,000 isn't uncommon, which means that practically all equipment is second hand. Such firms at the outset are usually housed in basements, garages, and the like to keep working capital fluid. Even so, owners starting up in business tend to underestimate how much capital they will need. This capital can only be met by long-term funds, yet owners will grasp at short-term straws, will pay exorbitant interest rates to get money to keep going.

In short, the owners will do almost anything to get their hands on money—short of selling a share in the business to outsiders.

Retained earnings are, of course, the best way to pay for new equipment, yet small shop owners find it almost impossible to accumulate enough money to pay for the costly and precise machines they need today.

Next to retained earnings, long-term loans are the most desirable way of paying for new machines, but they are all but impossible for the average satellite shop to get, and those shops that do get long-term loans often settle for far less than the amount they want. Or they must pay higher-than-expected interest rates. To secure the loans, either real estate or equipment mortgages must be taken out. The former aren't too hard to get, but equipment mortgage money is tight because the equipment more often than not is highly specialized and cannot be resold for much. Practically no credit is available, incidentally, on equipment purchased second hand.

Satellite shops often turn to the Small Business Administration for financial assistance, but many are turned down because they have no demonstrated earning ability, lack sufficient collateral, and have insufficient equity investment. It is a common complaint of small companies that SBA's loan demands are far too stringent. For example, one metalworking subcontractor to the farm machinery industry received an SBA loan only by pledging all its assets, limiting its salaries, declaring no dividends for 10 years, and by accelerating payments on the loan to the extent of 50% of earnings before depreciation reserves and taxes. In fact, the collateral on a replacement basis was worth double the amount of the loan.

Outside investors are hard to get because of high risk; questionable marketability of shares of ownership; inadequate working capital; tendency to understate earnings, net worth, and assets; reluctance to relinquish control and share in the profits; inadequate management; insufficient owner's equity; and undemonstrated earning power in the case of new firms.

Fixed asset costs (machinery, tools) are high in small metalworking shops, even though many firms start with, and continue to buy, mostly second-hand equipment. One vicious circle that catches up some shops: To attract new work, the shop must buy a very expensive machine tool, yet such a purchase ties up virtually all working capital. Lack of money also can be a crucial barrier to expansion.

Said one small defense subcontractor, "Our greatest problem at this time is our inability to purchase new machines required in our industry under current demands from profits remaining after taxes. If we are to stay in business, these new machines are a must in order to meet rigid inspection of our products."

Those are the problems of the satellite shop. But lest it be thought that they are caught up in an inextricable web of mismanagement, feast and famine business, labor and financial troubles, the Kinnard-Malinowski study points out that they have their advantages over larger manufacturers, even the prime contractors they serve. Boiled down, these are flexibility, low overhead, and quality performance. Add to this greater speed of decision and intimate knowledge of the industries they serve, and the satellite shop becomes an indispensable adjunct to American industry.

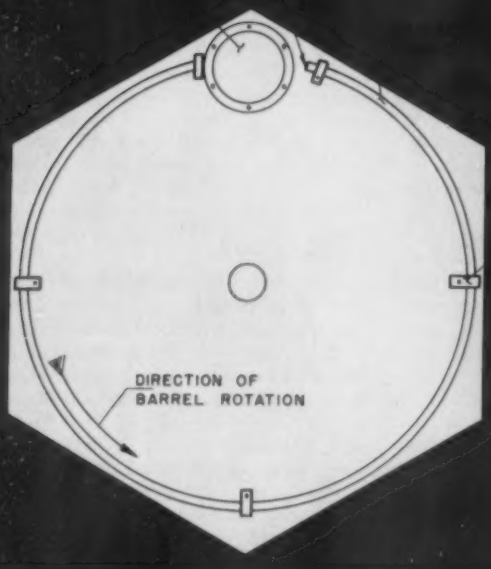
The Kinnard-Malinowski study is a report in depth on the problems of the satellite shop. It makes no recommendations, offers no solutions. Many of the problems are inherent in the shortcomings of management (perhaps mismanagement would be a better word). Others spring from too great a dependence upon too few customers, from tax depreciation policies regarded by virtually every small shop owner as unrealistic, from lack of capital, and from lack of government assistance.

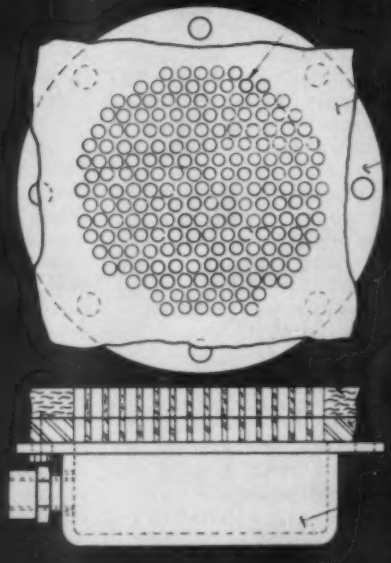
But one thing is certain, their economic health, even survival, is a matter of grave concern not only to business and industry, but to national defense.

FULL REPORT IS AVAILABLE

Copies of Kinnard and Malinowski's complete report, "The Metals Service Industry—A Case Study of a Satellite Industry," 36 pages, are available to readers of AMERICAN MACHINIST/METALWORKING MANUFACTURING at $1 per copy from

Reader Service
American Machinist/Metalworking Manufacturing
330 West 42nd Street
New York 36, NY





Vent allows gas to escape while barrel is rotating and is bent in the direction of rotation to permit liquid to drain into the barrel.

Cap covers small holes drilled through the barrel wall and barrel lining which keep small pieces of tumbling media and sludge from clogging the tube.

Automatic gas vent, non-clog media gate aid Watervliet in . . .

Taking the pressure off tumbling

By Kenneth W Horton and
E Noah Gould,
Watervliet Arsenal, Watervliet, NY

Two tumbling problems—one a hazard and the other a nuisance—have been solved by simple devices designed at Watervliet.

The hazard is created by a build-up of gas, caused by action of alkalis or acids on metal media or parts, in a closed barrel. In some cases, pressure has been great enough to blow the lid off a barrel; in others, the barrel has exploded. Solution: an automatic gas vent.

Non-clogging gate

Less hazardous, but still a deterrent to tumble-finishing efficiency: incomplete closure of the gate that controls flow of tumbling media in a storage bin. Solution: a non-clogging gate patented by Watervliet's Kenneth W Horton, now available on bins manufactured by BMT Manufacturing Co, Elmira, NY.

Various devices were designed in an attempt to release gas from the barrel, but proved impractical either because (1) tumbling had to be stopped, (2) liquid came out with the gas, or (3) the vent became clogged.

By contrast, a new Watervliet-designed vent allows excess gas to escape while the barrel is rotating, no solid or liquid leaves the barrel, and the vent stays clear.

Circular vent

The new vent is a circular piece of copper tubing mounted on the end of the barrel, near the rim. One end of the tube goes into a housing connected to the barrel. The other end is open.

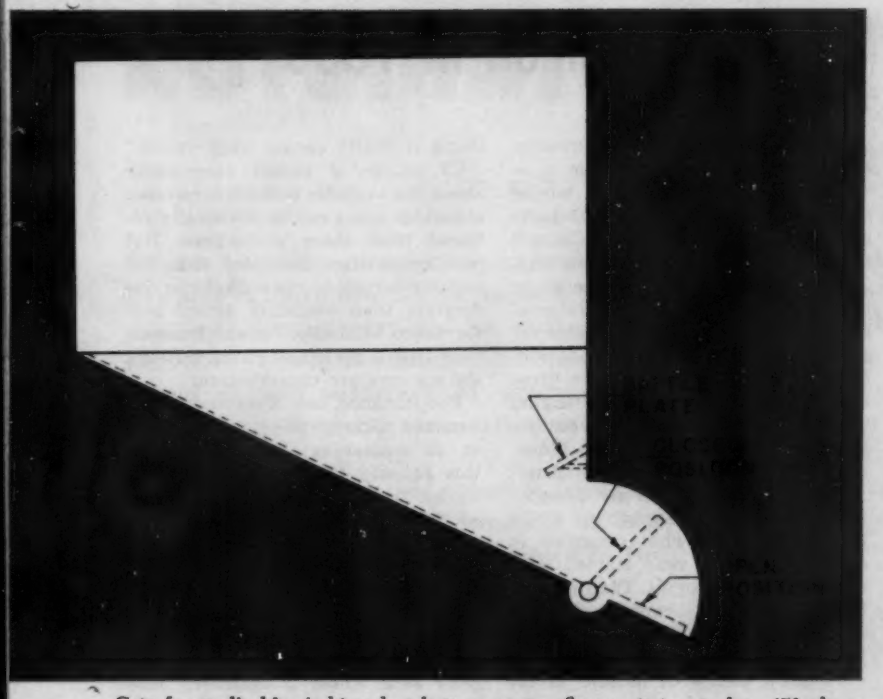
Under the housing are small holes, drilled through the barrel wall and barrel lining, and forming a screen. Because of the number of holes, some of them but not all can plug up at one time, so that there is always room for gas to escape. Liquid entering the tube drains back into the barrel, because the tube is bent in the direction of the barrel's rotation. If the direction of barrel rotation is alternated (for even wear), two tubes are necessary, each with its open end facing in an opposite direction, and each with its own shutoff valve.

Center vent tried

At Arsenal, we first tried this method of venting with the tube connected to the center of the barrel end. But because the tube connection has to be above the level of the liquid at some time during rotation (so the gas can escape), only 45% of the barrel could be filled under this arrangement. The present tube connection (close to the top of the barrel end) allows the usual full loading (60 to 75%) of the barrel.

Works with many metals

The new automatic vent has been used on twin-compartment barrels up to 36 inches in diameter and 6 feet long. Parts of steel, brass, copper, aluminum, magnesium, and other metals—ranging from a frac-



Gate for media bins is hinged at bottom to stop flow as it is raised to 45° above horizontal. Baffle plate supports part of the load.

tion of an ounce to 10 pounds, have been tumbled.

One caution: The gas most often liberated is hydrogen, so open flames must be kept away from the automatic vent.

Second Watervliet-created tumbling device eliminates the problem of media clogging in the storage bin. In conventional storage bins, the flow-control gate either slides up and down, or is hinged at the top so as to swing open at the bottom. It's hard to close the gate completely because material often wedges in the opening, allowing other material to flow through. Even worse, when the tumbling media is of mixed sizes, large pieces sometimes hold the gate open while smaller pieces flow through.

Watervliet's non-clogging gate is hinged at the bottom, creating an uphill path too steep for the media to climb as it is closed, and stopping material flow completely as the gate reaches a 45° angle above horizontal. Even though there is thus an opening above the top of the gate, nothing flows through it because of the friction of pieces of media on each other and on the gate. A baffle plate in the bin supports part of the load and makes it easier to close the gate.

Hinge protected

The likelihood of clogging in the hinge of the gate has been minimized by making the opening next to the hinge very small. This prevents all but very fine particles from entering the hinge. If, as is accepted practice, the medium is washed after it is taken from the tumbling barrel, there should be few fine particles mixed with it in the bin.

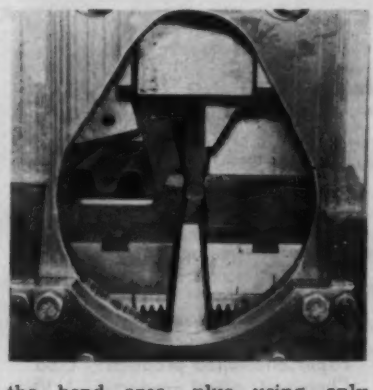
Bin gates are opened and closed by handles equipped with a ratchet and notched quadrant for closer control of media flow. They operate as well with a mixture of media sizes as with one size.

Boeing-designed machine corrugates superalloy sheet

Superalloy sheet can now be formed into corrugated sections to height tolerances of 0.003 in. to meet structural design requirements of ultra-high-speed aircraft.

The job is being done on a machine designed and developed by Boeing Airplane Co's Aero-Space Division (see photo), which works with nickel and cobalt-base metals capable of withstanding the high temperatures and stresses of hypersonic flight. For this purpose, corrugated superalloy sheet is spotwelded in place between two smooth sheets of similar metal to form panels for wing or fuselage skins.

Boeing's machine consists of two tables, with a punch and pressure bar between. Additional hydraulic bars include a combination clamp and vacuum chuck, which holds the flat sheet against one die during forming (photo at far right), aligns it for the corrugation cycle, and picks up and feeds the material.



Alignment and movement of the material through the machine are automatic. A metal sheet is clamped between the punch and pressure bar, with tables extended. The punch and bar move downward together as the two tables move toward each other —stopping when the desired angle of bend is obtained.

Confining of metal elongation to the bend area, plus using only enough elongation to set the formed corrugation, produces uniform corrugations with a minimum of material thin cut.

The punch then rises, clamps are released, and the vacuum chuck picks up, feeds, and aligns the sheet for the next forming cycle. Present machine handles 36-in. widths.

Capital spending to hit $37 billion in 1960

American industry plans to spend 14% more for new plant and equipment this year than last, with a total outlay of $37 billion this year compared to $32.5 billion in 1959.

This upswing was disclosed in a survey made, and just released by, the Securities and Exchange Commission and the Department of Commerce. Such a rise would boost outlays up to the all-time high established in 1957.

Capital spending is a potent factor any year, but is particularly crucial for 1960. After several months of disappointing developments, including cutbacks in auto production and a stock market downturn, this predicted upturn is a strongly reassuring note. Three months ago, business analysts were assuming that restocking of inventories after the steel strike would spark the economy for the first six months, with a rise in plant and equipment spending taking up any slack in the latter half of this year.

But inventories have been filled more rapidly than anyone forecast. If capital spending by industry had shown any softness many forecasters would have immediately lowered their predictions for the year.

Industry economists who advise members of the Commerce Department Business Advisory Council found that 14% gain heartening. "Our predictions are still averaging around $510-billion Gross National Product for the year," one economist said. "Maybe we're not quite as confident of hitting it as we were three months ago, but we're not changing our minds on the basis of what we know now, particularly with industry's spending plans looking so firm."

Government analysts are comparing the plant and equipment situation today with what occurred in early 1956. That year started with spending on a plateau. Then outlays began to climb, rapidly for six months then at a slower pace, and kept climbing for a year and a half.

"There's plenty of muscle in the current rise," one analyst pointed out, "particularly in the way every category of manufacturing is sharing in the swing. If it were a case of a couple of sensational performers like steel and autos outweighing a lot of small declines, I wouldn't think it really meant very much."

Of course, if recent uncertainty about the business outlook continues, actual spending can be drastically reduced from these predictions. But past experience indicates that the current survey is more likely to understate than overstate actual performance. Usually, when business goes into a period of rising outlays, the surveys are conservative.

For instance, last November, businessmen thought they would spend at an annual rate of $34.4 billion this January-March. But the survey shows they are spending at a rate of $35.3 billion.

This first-quarter rate will increase to $36.9 billion in the April-June period if present plans are carried through, and will go to $37.9 billion in the second half of the year. The $37 billion seen for the year as a whole is unusually close to the results of the McGraw-Hill survey of capital spending plans published last fall (*AM*—Nov 16 '59, p133). It indicated $37.2 billion for 1960. The surveys do not cover exactly the same industries and, therefore, are not exactly comparable.

Industry's 1960 Capital Spending Plans

Seasonally adjusted annual rates, billions of dollars

	1959 Actual		1960 Estimate		1959	1960	% change,	1960 to all-time
	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Actual	Estimate	1959	high
MANUFACTURING	12.25	12.87	13.89	14.57	12.07	15.13	+25%	− 5%
Durable-goods industries	5.83	6.16	6.88	7.23	5.77	7.66	+33	− 4
Machinery	0.95	0.97	1.01	1.10	0.91	1.19	+30	− 7
Electrical machinery	0.55	0.56	0.66	0.66	0.52	0.74	+43	+24
Motor vehicles, parts	0.68	0.74	0.83	0.91	0.64	1.02	+59	−40
Transportation equip.	0.41	0.38	0.40	0.43	0.39	0.47	+19	−15
Iron and steel	0.90	1.14	1.48	1.65	1.04	1.73	+67	equal
Nonferrous metals	0.28	0.31	0.33	0.32	0.31	0.37	+19	−54
Nondurable-goods industries	6.42	6.71	7.01	7.34	6.30	7.47	+19	− 6
Food and beverages	0.83	0.86	0.88	0.88	0.83	0.84	+ 2	− 1
Textile-mill products	0.45	0.50	0.52	0.57	0.41	0.47	+14	+ 1
Paper and allied products	0.66	0.69	0.69	0.77	0.63	0.70	+10	−14
Chemicals, allied products	1.30	1.31	1.41	1.40	1.24	1.64	+33	− 5
Petroleum, coal products	2.47	2.57	2.69	2.78	2.49	2.93	+18	−15
NON MANUFACTURING	21.10	20.71	21.43	22.34	20.48	21.89	+ 7	
Mining	1.01	1.04	0.96	1.01	0.99	1.00	+ 1	
Railroads	1.28	0.85	0.99	1.13	0.92	1.02	+11	
Transportation (non-rail)	2.17	2.15	2.26	2.43	2.02	2.14	+ 6	
Public utilities	5.58	5.48	5.80	6.02	5.67	6.07	+ 7	
Commercial, other	11.06	11.19	11.42	11.75	10.88	11.66	+ 7	
TOTAL	33.35	33.58	35.32	36.91	32.55	37.02		

AUTOMATION IN RUSSIA

— as viewed by Soviet engineers

Efforts to make automation more flexible, to apply it more broadly to manufacture of rotating components, and an unusual approach to machine standardization will be found in this summary of progress and problems in applying automation to manufacturing in the USSR.

All information in this report is based on the Soviet publication "Stanki i Instrument," Vol XXX, No. 8, as translated by the Production Engineering Research Association of Great Britain. In condensing it for this report the editors have made every effort to retain the flavor and attitudes of the original Soviet authors. Explanatory comments by the editors are clearly identified.

This report is designed to keep up-to-date the continuing coverage by this magazine of Russia's intensive efforts to expand and develop her metalworking industries.

Moscow Area Plans: 1959 to 1965

In the present seven-year plan the Moscow machine tool industry plans to manufacture 400 transfer machines, or automatic lines (as they are called in the Soviet Union). During the previous seven-year plan the Moscow industry produced about 40 transfer machines.

In the present period, 1959-1965, the USSR expects to produce 1200 transfer machines. (For comparison, the 1958 AMERICAN MACHINIST Inventory reports 8500 transfer machines in use in the US—Ed.)

The Moscow council intends to completely automate a number of factories, among them the Likhachev auto plant where it is expected to reduce labor by 50% and increase efficiency (by which is probably meant output) by 25 to 30%. About 90% of bearing production will be automated. Mechanized shops are planned for manufacturing micrometers, vernier calipers, taps, threading dies, and milling cutters in the Kalibr, Frezer, and other factories.

In order to achieve this goal, it is proposed to increase the output of existing factories to produce automatic lines and to have other factories also specialize in this work:

The former Pod'emnik factory will now manufacture special machines and automatic lines.

The former Stal'most factory will produce unit machines and automatic lines.

The former Strommashina factory will make special machines and standard units for unit machines.

The Kalinin machine building factory will be partly converted to build automatic lines.

Production will be specialized with given units produced by one factory for all factories using them. This will permit the size of batches to be increased.

A key plant in the program is the special purpose machine and automatic line factory (the former Pod'emnik plant) which will be the main factory for automatic lines handling rotating components. This factory will take special machines produced as standard items by other factories, add individual special machines of its own manufacture when required, build loading and unloading devices, conveyor mechanisms, and will assemble and debug the lines.

Three organizations are identified as doing the design work for all the automatic lines:

SKB-1, which is part of the Moscow Council of National Economy and is responsible for lines to handle body-type parts (those that remain stationary during machining).

SKB-6, also part of the Moscow Council and responsible for automatic lines to handle rotating components.

OKB, the Joint Design Bureau.. This bureau appears to be primarily concerned with inspection equipment.

The new range of standard units developed by SKB-1 in the past two years is illustrated in Fig. 1 to 5. Fig. 6 shows the typical layout of a section of an automatic line made from these unit machines. These standard designs have been accepted

American Machinist / *Metalworking Manufacturing* **Special Report No. 485 • March 21, 1960**

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Standard Units Adopted for Transfer Machines by the Moscow Council

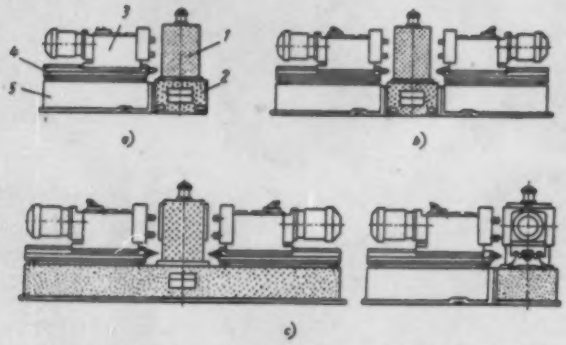


Fig. 1. Horizontal unit machines: a, one-sided; b, two-sided; c, three-sided. Parts are: 1, work fixtures; 2, middle part of bed; 3, power head; 4, slides; 5, base

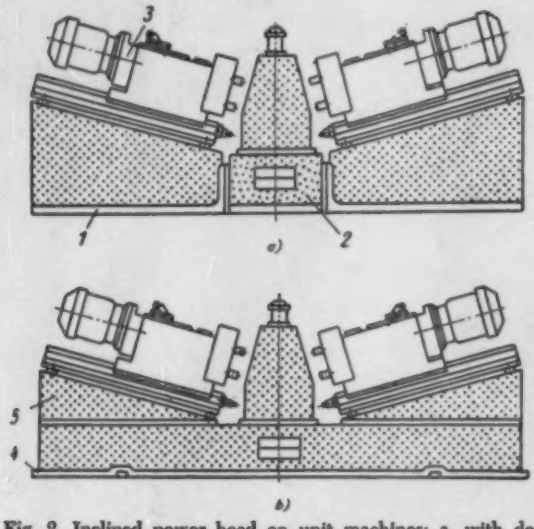


Fig. 2. Inclined power head on unit machines: a, with detachable beds; b, with single bed. Parts are: 1, bed; 2, middle part of the bed; 3, power head; 4, bed; 5, inclining block

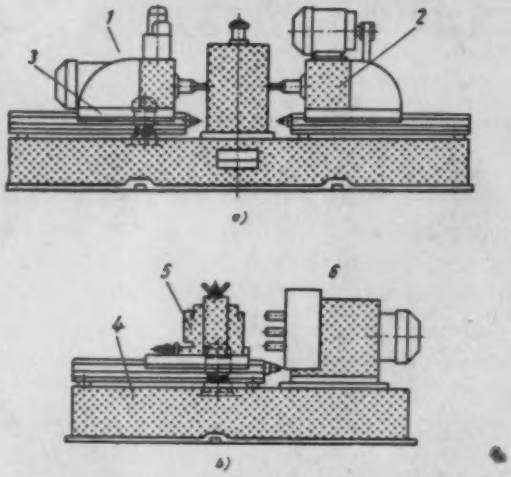


Fig. 3. Unit machines with power tables: a, two-sided; b, one-sided with traveling component. Parts are: 1, boring head with fixed spindles; 2, boring head with belt transmission; 3, power table; 4, bed; 5, power table with component; 6, stationary head with tools

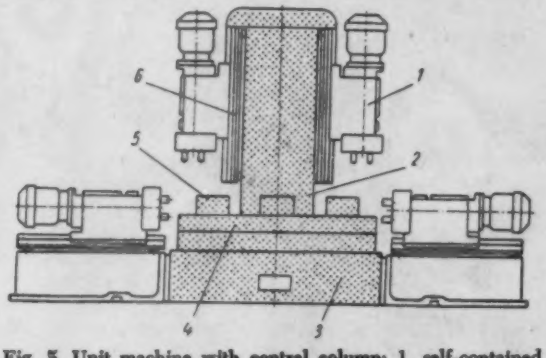
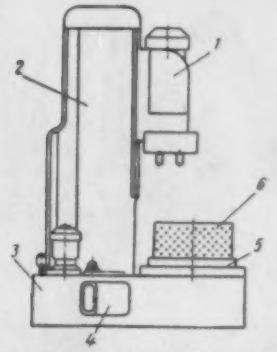


Fig. 5. Unit machine with central column: 1, self-contained power head; 2, column; 3, base; 4, rotary table; 5, work fixture; 6, slides



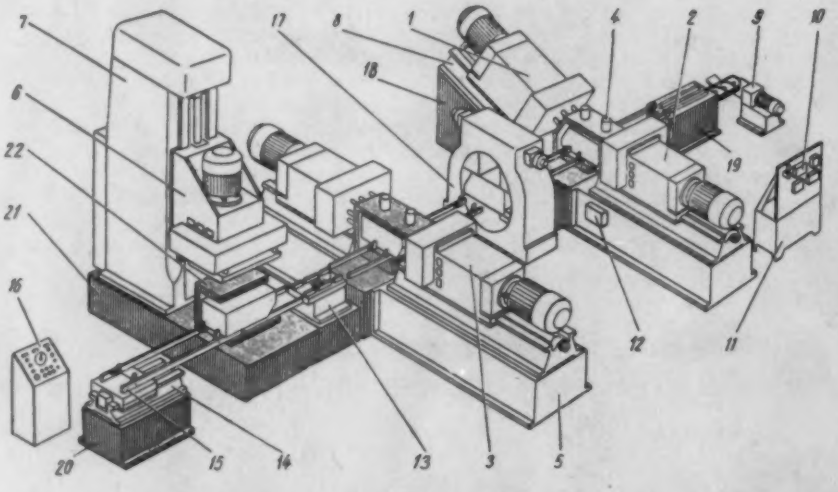


Fig. 4. Rotary multi-position table on unit machine: 1, power head (non self-contained); 2, column; 3, base; 4, hydraulic feed and rotary table drive; 5, rotary table; 6, work fixture. (A non-self-contained power head appears to be one containing power for spindle rotation but not for feed—Ed)

for production by the Ordzhonikidze machine tool factory.

In designing lines for rotating components, the problem to be solved is not only standardization of intermediate mechanisms, but wide application of machines that are being produced in series and obtained by the factory producing the automatic line from the specialized machine tool factories.

Typical automatic lines are now designed by SKB-6 to handle a predetermined range of sizes. For example, three classes of lines have been established to machine stepped shafts:

No.	Diameter, in.	Length, in.
1	0.787 to 1.575	3.937 to 11.811
2	1.181 to 1.969	11.811 to 19.685
3	up to 3.97	19.685 to 31.496

These lines generally use the milling-centering machines, single-spindle hydraulic copying machines, or two-spindle machines based on those produced by Ordzhonikidze and the centerless grinding machines produced by Vitebsk machine tool factory. In some cases 80 to 90% of the machines in a line can be standardized types.

These lines can be reset from one size to another within the established range. Such lines can be rebuilt for new components and retain up to 80 to 90% of the original line because of the high degree of standardization.

At present there are many machine tools that are not suitable for use in automatic lines. These include spline-milling machines, spline-grinding machines, keyseating machines, grinding machines for distributor camshafts, crankshafts, and other types. ENIMS has developed a number of models suitable both for inclusion in automatic lines and for working independently but such machines are not being produced by the factories.

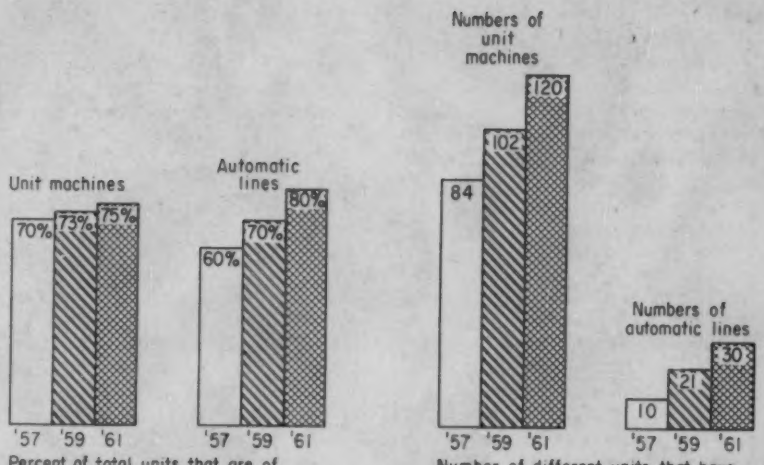


Fig. 7. Past and planned progress in achieving standardization of units for automatic lines both as percent of Moscow Area production and in actual numbers

ENIMS concentrates on lines using standard machines

In addition to the eight types of lines for rotating parts described below, ENIMS (Experimental Scientific Institute for Machine Tools) recently decided to return to the design of automatic lines for body type components in order to make them more flexible.

Carburetor bodies were chosen for this purpose because they have a great number of sizes and experience shows that these are modified not less than once in two years and completely redesigned after three to four years.

To build automatic lines from automated general-purpose machines it is necessary to organize centralized manufacture of typical conveyors, loading and magazine devices, instruments and apparatus for dispatch and counting, and to specialize factories to build automatic lines from such purchased equipment.

Because the cost of the blank constitutes 50 to 70% of the component cost in mass production, particular attention must be paid to the problems of improving the blank.

A prime requirement is the automation of main and auxiliary operations in foundries and in forging.

Studies of the lines already in use show that when automatic lines are introduced, the working efficiency is increased 2 to 6 times, machining costs are reduced 30 to 50%, and floor space is reduced by from 20 to 50%.

Here are some examples of current work by ENIMS in the development of automatic lines for more complicated parts than the transfer machines for body-type components.

Fig. 6. Section of an automatic line made up from unit machines. Items 1 to 17 are standard, items 18 to 22 are non-standard, constructed for this transfer machine: 1, 2, and 3, self-contained power heads; 4, component clamping cylinder; 5, bed; 6, non-self-contained power head; 7, vertical column; 8, slides; 9, chip conveyor drive; 10, joint-face hydraulic apparatus; 11, hydraulic unit; 12, automatic lubrication pump; 13, rotary table (for part orientation); 14, component conveyor drive; 15, component conveyor; 16, control panel; 17, component orienting device; 18, inclined bed; 19 and 20, beds; 21, base; 22, work fixture

1. Pistons

Automatic production is being developed for a new automatic car factory, based on the experience with the first automatic car factory. The new line is based on flexible connections.

All parallel machines work independently with no inter-connection of flow lines. Components are delivered and taken away by conveyor with both conveyors lying outside the working zone of the machines.

The conveyors double as storage magazines for parts, with additional storage provided by multi-stage reversible horizontal belts placed over the conveyors. Work will be loaded and unloaded by devices with spring-loaded claw type clamps.

(From this sketchy description, it appears that the original line, like early lines in the US, was less flexible and has caused some problems with excessive downtime—Ed.)

2. Rotor Shafts

Four rotor lines are now in operation and three more are being built. Most of the individual machines for

these lines were not available and had to be designed by ENIMS.

Single flow design has been accepted with the conveyor path outside the line. Work is transferred to and from machines by single-clamp loading and unloading devices. The line is divided into two sections with an automatic magazine between sections.

This type of line is simple and reliable but has the disadvantage that the time required for an auxiliary operation builds up and increases the cycle time. For rotor shafts, this is acceptable because one of the operations, groove rolling, is much longer than the remaining operations.

The first lines were not divided in sections and did not include automatic balancing. The later lines (with balancing added) do have the division into two sections with a magazine between.

Vises to clamp the shafts can be reset to accommodate different shaft lengths and individual machines can be disengaged from the line.

3. Splined Shafts

An automatic line designed by ENIMS has been built by the Stankokonstruktsiya factory for the Krasni Proletarii works. The most widely used splined shafts have diameter of 25 to 50 mm (0.984-1.969 in.) and length of 150 to 500 mm (5.906-19.685 in.). This new line will handle most of this range.

The ordinary method of machining splines by milling was too slow. A new method and machine has been developed to plane the splines simultaneously with form cutters at rates five to six times higher than milling. (This is probably an external spline broaching machine—Ed.) All the remaining machines are standard types.

The line for splined shafts is similar to those for rotor shafts except for the loading-unloading devices. These are double, rather than single, clamping devices. Substitution of a blank for a machined component is carried out during the conveyor travel.

To reduce resetting and adjustment time on the semi-automatic hydraulic copying lathes, slotted block toolholders are used. Each consists of two parts, body and block. The bodies are mounted permanently on the lathes and interchangeable blocks are pre-set away from the machine. Placing a block on the machine takes less than 20 sec.

Instead of collet chucks, combination driving chucks are used in which the main clamping force is produced by rollers working on the principle of a free-wheel clutch.

Grinding machines on the line are standard types with automatic sizing devices.

4. Crankshaft Balancing

Lines for dynamically balancing crankshafts and other components have standard elements that can be assembled into various forms, depending on the component to be balanced.

Direct determination of out-of-balance vectors is carried out by an electronic device and balance correction is handled by automatic drilling machines. Balancing accuracy is 30 gm cm (0.026 lb in.) instead of the 150 gm cm (0.130 lb in.) previously obtained.

5. Spur gears

The automatic line designed by ENIMS for the Krasni Proletarii Works can machine 10 sizes of single spur gears at an average production of 120,000 gears per year. The size range of the line is OD of 100 to 220 mm (3.937 to 8.661 in.), bore diameter of 28 to 50 mm (1.102 to 1.969 in.) and a module of 1.5 to 5 mm (0.059 to 0.197 in.).

All machines in the line were specially designed and have vertical component spindles permitting single type loading devices. To eliminate local losses from stoppage of individual machines, the line has been divided into two sections that can work independently to or from an intermediate magazine.

6. Compound Gears

The success of the spur gear lines has led to the design of lines for compound gears. This requirement was based mainly on the compound gears that will be produced in 1965 in the Russian motor car and tractor industry:

Diameter of the larger gear		Percent of annual production
mm	in.	
50- 80	1.969- 2.149	1.0
80-120	2.149- 4.724	55.0
120-200	4.724- 7.874	38.6
200-280	7.874-11.024	3.4
280-440	11.024-17.323	1.1

Because of the small number of gears under 80 mm, there are no plans by ENIMS to develop a line for their manufacture. Although gears above 280 mm also represent a small proportion, these gears weigh 24 kg (52.9 lb) and more making their manufacture labor consuming.

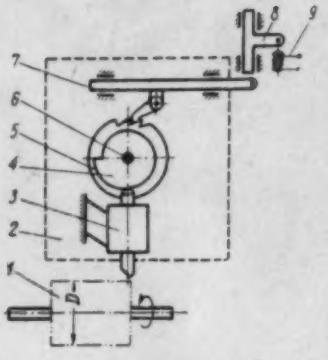


Fig. 8 Tool adjusting device for rotor turning lathe. In turning shaft 1, the toolholder 3 is fixed to toolslide 2 with parallel springs. Profile cam 4 is rigidly fixed to ratchet wheel 5 and both are free to rotate on pin 6. Shaft is measured and if it is beyond limits, one floating gage of the measuring instrument actuates solenoid (this happens when toolslide is to the left of component at end of cut). Solenoid moves rod 8 so that it lies in the path of plunger 7. As toolslide returns to starting position at right, plunger 7 is stopped by rod 8 and rotates ratchet wheel 5 and cam 4 by means of a pawl. This causes cam to advance toolbit by 0.02 mm (0.000,08 in.). When the complete cam profile has been used, the toolholder has moved 1 mm (0.039 in.) and a signal is given to reset the device and change the tool

Therefore, lines will be developed for compound gears from 80 to 440 mm.

The first line is now being manufactured and is designed to produce 100,000 compound gears per year. The line includes 13 unit machines including an automatic device for final inspection.

This line is an in-line transfer with the conveyor path passing through the working zone of the machines. An intermittent bar conveyor is used with a hydraulic motor at the middle of the line to impart reciprocating movement. Vertical movement to all clamps is provided through rack and pinion mechanisms by rotating the bar.

7. Bevel Gears

An automatic line for bevel gears has been designed, particularly to handle the crown wheel in differentials. The weight of these gears is 11 kg (24.3 lb) and they are made of chrome-nickel steel.

This line will consist of seven machining sections with the end of each section connected to the beginning of the next by flexible conveyors. This will permit the factory to introduce the line by sections. The equip-

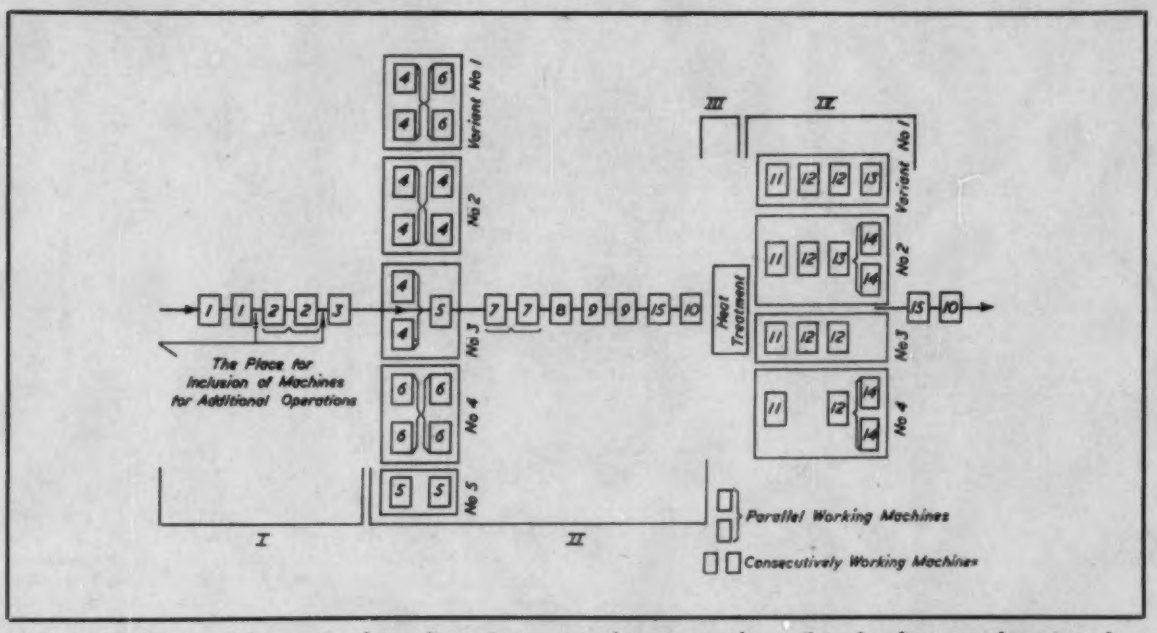


Fig. 9. Basic diagram of the compound gear lines. Section I, blank preparation; II, gear cutting; III, heat treatment; IV, machining after heat treatment. Key: 1, vertical turning-boring machine; 2, vertical broaching machine; 3, vertical lathe; 4, gear hobbing machine; 5, tooth profile shaping machine; 6, gear shaper; 7, tooth radiusing machine; 8, washing unit; 9, gear shaving machine; 10, inspection unit; 11, calibrating machine; 12, tooth planishing machine; 13, vertical internal grinding machine; 14, gear grinding machine; 15, washing unit

ment is mainly general-purpose machines with automatic loading devices.

8. Flanged Components

More than 30,000,000 flanged components are manufactured every year in Russia, usually on universal equipment with limited automation.

An analysis of flanged components shows that they may have to be machined on either one or both sides of the collar and that they may have: I, a smooth or splined bore; II, a through bore with stepped diameter; III, a blind bore.

Type I components are not found with one-sided flanges in the most widely used machines. All one-sided flanges and all two-sided flanges with blind bores can be fully machined on multi-spindle automatics or on multi-position unit machines.

Therefore, adaptable automatic lines will be made for flanges to be machined on both sides which have smooth, splined, or stepped bores.

SKB-6 Plans to Manufacture Rotating Components

Rotating components are in the majority in modern machines and mechanisms both in variety and number of parts. The automation of such parts was started only a short time ago because of the considerable technical problems.

During the last 10 years, automatic lines have appeared to produce aluminum pistons, two sizes of anti-friction bearings, wheel spindles, and shaped bushings.

Present Work

The difficulties in designing automatic lines for rotating components are mainly the result of the great variety of design forms and sizes and the many machining operations required. It is necessary to automate not only metal cutting or forming, but all forms of heat treatment, washing, drying, inspection, assembly, anti-corrosion treatment, painting, and packing.

It is impossible, even with an increased industrial capacity to manufacture automatic lines, to design and manufacture in a short time many hundreds of sizes and types of automatic machines and the other equipment needed to manufacture such components as axles and nuts, shaped bushings with blind bores, valves, splined shaft, and bearing races.

This problem can be solved only by dividing the components into classes, and designing lines to produce one class of component differing only in size.

This work was started by SKB-6 in 1958 on anti-friction bearings. Twelve classes or size ranges of bearings were established (see Fig. 10). An automatic flow line should be designed for the manufacture of bearings within a size range and should consist of self-contained automatic lines to turn the inner and outer races, heat treat the races, grind the inner and outer races, manufacture rollers, snap rings and cages, and select, assemble, and pack finished bearings.

Machine tools and conveyor methods should allow the resetting of the line to manufacture another type of bearing in the size range.

SKB-6 has designed flow lines for Class IX and X bearings and the part of the Class XI line to turn bearing races. Design of a Class III flow line has been started.

The same principles are now being applied to the design of flow lines

Class of automatic flow line	Type of bearing	Range of sizes (diameter of the outer race) mm.	Tentative productivity rate of one automatic flow line in millions of bearings per year	Number of automatic lines in one flow line
0	Ball bearing	10— 30	5	6
I	ditto	30— 40	5	6
II	ditto	40— 62	5	6
III	ditto	62—100	3	6
IV	ditto	100—180	2	7
V	self aligning	40— 62	4	6
VI	ditto	62—100	2	6
VII	taper rolling	40— 62	2	6
VIII	ditto	62—100	2	8
IX	ditto	100—180	1.5	9
X	universal joint bearing	28— 50	6	5
XI	railway	240—280	0.2	17

Fig. 10. Classification of automatic flow lines for manufacturing anti-friction bearings

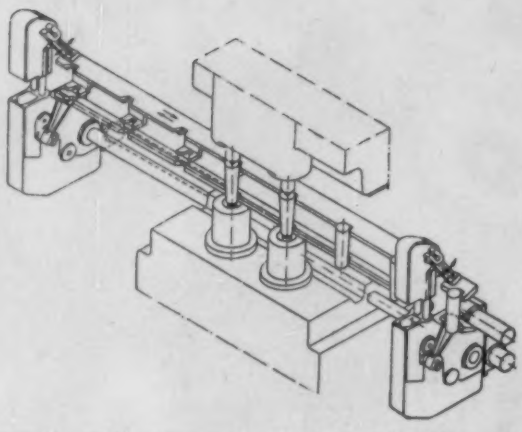


Fig. 11. Rigid conveyor to connect 2-spindle lathes. Two bars with V-slots carry the components. After the parts have been placed in position and gripped by centering chucks, the reversing bar moves the conveyor bars away from the cutting zone

for valves for autos and tractors. Sometime in 1960, design will be completed on an automatic shop for machining, and assembling with its nut, the roller axle of the DT-54 tractor. This shop can also be used to manufacture stepped shafts.

Individual Machines

Few metal cutting machines are produced at present suitable for use in automatic lines for rotating components and there is an almost complete lack of machines for automatic inspection, assembly, washing, etc.

This problem can only be solved by maximum use of existing metal cutting machines.

In 1958, SKB-6 developed a range of multi-spindle bar and chucking automatics for the Kiev Machine Tool Works. So far the Kiev works has produced the 8-spindle bar automatic (Model 1265-2) for tubes up to 50 mm (1.969 in.) and is completing an 8-spindle chucker.

These machines are designed for automatic loading of single blanks or tubes, automatic unloading, and inspection devices to stop the machine in case of tool wear or failure. These machines have double indexing. That is, the spindle head can index two positions at a time to produce two parts on each index when the parts can be produced in four spindle positions. The machines are designed for use with carbide tools and soluble oils.

The Kiev works has also produced the first KA-76 automatic chuckers. These machines have 100 mm (3.937 in.) chuck capacity in an 8-spindle head only 400 mm (15.748 in.) in diameter. Set up for production of closed end universal joint bearings, the machining time is 1.8 sec and auxiliary time is 1.7 sec. Thus in 3.5 sec the machine produces two finished races.

Ordzhonikidze is producing a 2-spindle automatic lathe (Model 19S12D) for stepped or shaped shafts 150 to 500 mm (5.907-19.685 in.) long at 250,000 units per year. The rigid conveyor to connect these machines is shown in Fig. 11. Toolslides are placed overhead in these machines and chips are removed by a screw conveyor.

SKB-6 has designed two sizes of automatic two-spindle surface grinders with a circular table, a through-feed centerless grinder, and five sizes of internal centerless grinders.

Such work is insufficient to insure greatly increased production of automatic lines for rotating components. During the next two years Krasni Proletarii should produce vertical multi-spindle automatic machines operating parallel and in line and automatic lathes for crankshafts and camshafts. The Vitebsk Kirov factory should produce automatic centerless grinding machines for plunge grinding; the Moscow Grinding Machine Factory should produce automatic spline grinding machines; Kharkov machine tool works, automatic grinders for crankshafts and camshafts; Leningrad Ilich and Saratov machine tool works should produce automatic internal grinding machines. (It is not clear whether this paragraph is a prediction, an order, or a plea—Ed.)

The Problem of Mechanizing Small Lot Production

In the mass production industries, automation has been widely applied. In the machine building industries its application is absolutely inadequate.

The design of new special automated equipment and special automatic lines cannot be transferred to machine building with small batch manufacture, and frequent component changes.

This would contradict the requirements of technical progress, of continuous improvement of design, and of increase in types of machines.

The other major approach to automation, that of modernizing existing universal machines, has positive advantages for small lots, but it cannot be considered as a basis for the solution of problems that confront the Russian machine building industry.

Even when they are modernized, universal machines take second place

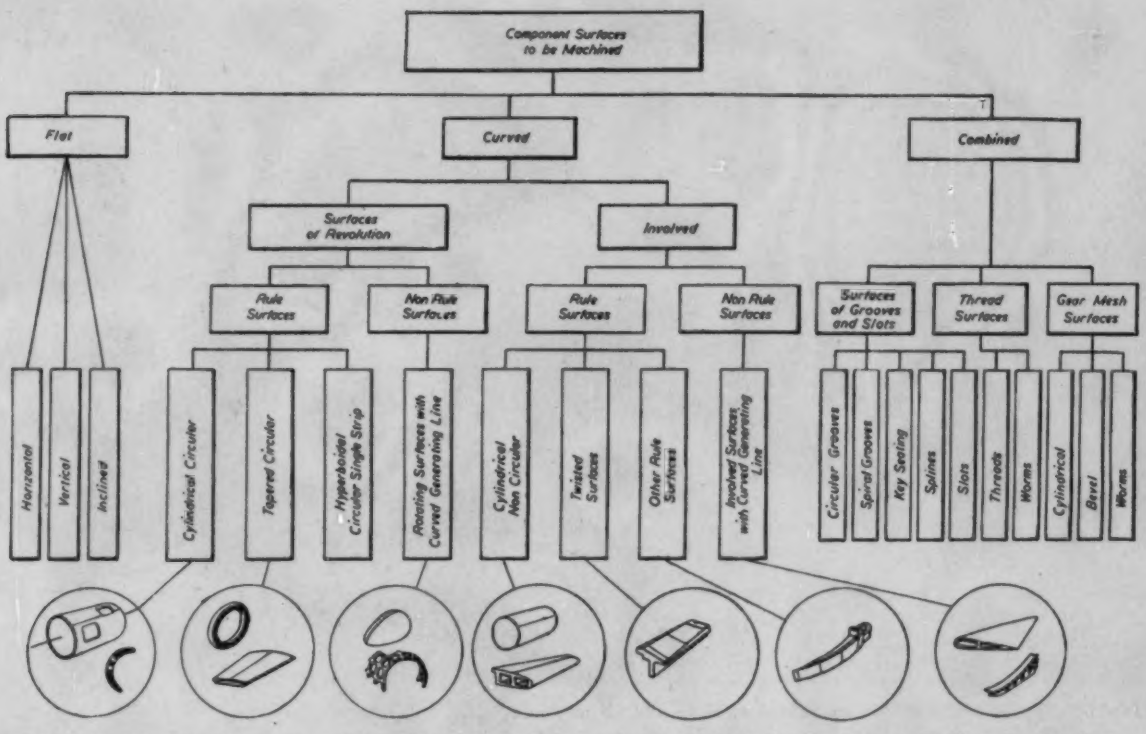


Fig. 12. Classification of surfaces to be machined that will be used as the basis in developing specialized machine tools

to special machines as far as productivity is concerned. The considerable loss on special tooling (at present 80 to 85% of the total time and costs of preparing for the manufacture of new components) is a main disadvantage.

A solution to this problem may lie in the use of specialized equipment (by which is meant equipment intended to carry out one type of operation on a single class of components in a wide range of sizes.)

Calculations show that 40% of the metal cutting equipment in machine building factories could be specialized. At the same time, up to 90% of the elements going into unit machines can be standardized.

Specialized unit machines have suitable setting elements built in. They may be standardized mechanisms for setting cutting conditions, position and traverse of the heads or table, etc, or interchangeable fixtures that can be quickly set for tooling, clamping, or locating fixtures.

A method to design special and specialized equipment is suggested: classification of the components to be machined and standardization of their machining method; classification of the component surfaces to be machined, and development of typical working, auxiliary and preparatory movements; standardization of design elements, and development of working assemblies.

The basis chosen for grouping surfaces to be machined is shown in Fig. 12. A chart has been made for each of these surfaces to show the working movements that can be used to produce the surface, and all working movements have code numbers.

A typical assembly of equipment by this method is shown in Fig. 13.

All construction elements of metal cutting equipment can be divided into five groups: base elements, drives, transmission, control, and auxiliary elements. Within each of these groups, construction elements can be subdivided by function.

Next is the need to get the maximum number of combinations from the minimum number of construction elements. Selecting bed slideways as a separate construction element, for instance, will allow various combinations to be obtained by combining a limited number of slideway types with one bed.

To insure interchangeability, the joint faces of the units should have the simplest form possible, and the fixing devices should be standardized. One of the main conditions of unit construction and standardization is that dimensional adjustment of the position of the units in relation to each other is possible. This is particularly important in the design of specialized fast setting machines.

Two main methods of design of specialized equipment from standard units have been noted: 1, standardization of the elements of basic models; 2, converting special unit machines into universal machines.

In the first method, a basic model is made and a range of standardized machines is then designed using elements of the basic model.

In the second method, standardized fixtures with quick resetting are based on existing unit machines and the standard elements that have been developed for such machines.

Both methods are based on the classification of components and of the typical machining processes. Standardization requires both the division of processes into types and the standardization of tooling.

This system of design and standardization will reduce the time needed to furnish automatic equipment with minimum capital expenditures.

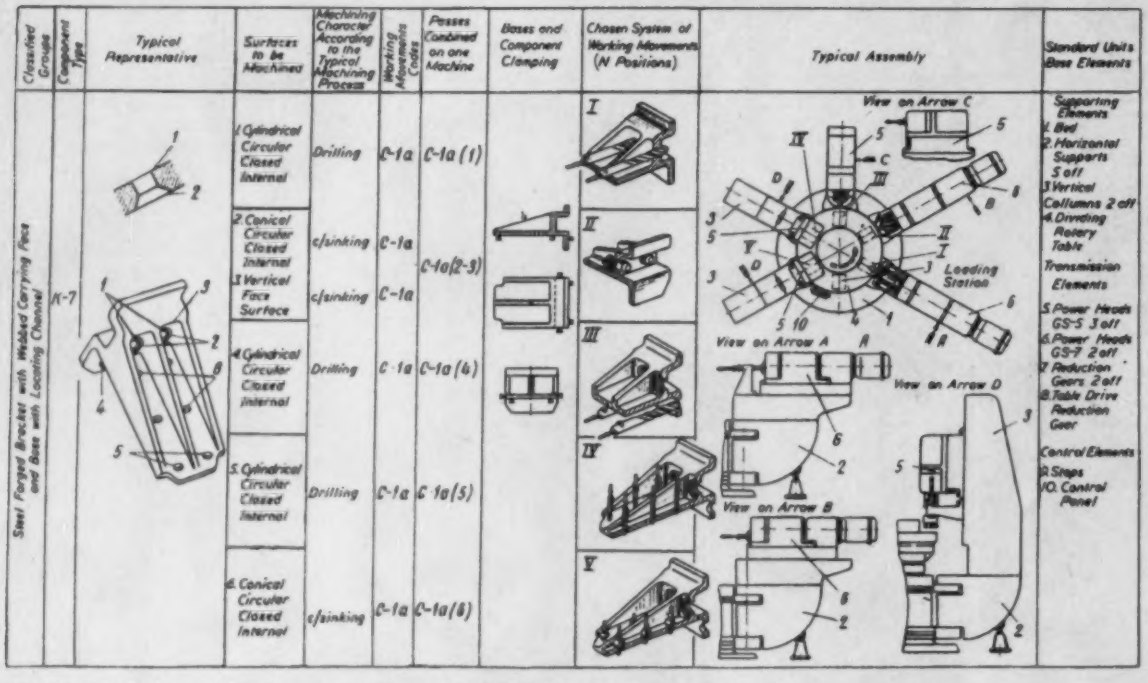


Fig. 13. Typical assembly of a specialized machine tool for machining class B (bracket) components

Inspection Devices for Automatic Lines

A final inspection section has been designed by OKB for the automatic axle line developed by SKB-6. Axles entering the temperature-controlled room pass first through a storage magazine where they remain long enough for temperature to stabilize throughout the axle. The axles then pass through a C-station automatic machine that inspects 31 features.

Accepted axles are placed on the conveyor while rejected axles are loaded into a reject magazine. When this magazine is filled the machine stops. At this point the operator engages rechecking and all rejected axles pass through the inspection machine again. The operating cycle of the inspection machine is 10% shorter than that of preceding machines and takes 75 sec. Axles are accepted from the line by storage magazines during rechecking.

Axles that are again rejected are delivered to the stand for hand inspection, after which they may be finally rejected.

OKB has also designed inspection equipment for automatic lines making bushings, and various types of bearing races.

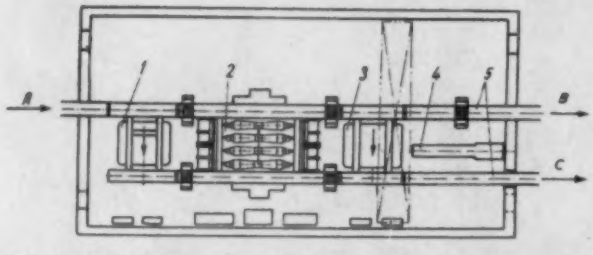


Fig. 14. Inspection section of axle line. A, inspect; B, accepted axles output; C, rejected axle output. Key: 1, temperature stabilization unit; 2, automatic inspection machine; 3, rejects magazine; 4, stand and instruments for manual inspection; 5, conveyor

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Paste . . . resin and hardener are mixed with wide blade, then applied to clean surface, even vertical surfaces. Advantage—good dimensions, low cost

The basics on epoxy tools:

How to make them; What they do best

By Stanley Munson,
Ren Plastics, Inc, Lansing, Mich

Some of the toughest tools you'll find around any sheet metal shop are made from plastic. They're so tough, in fact, that it's a temptation to hit, say, a plastic die with a hammer—just to see the hammer bounce off harmlessly.

Just try that with a polished metal die!

Toughness of plastic tooling may be taken for granted. More often than not, a polished metal die comes back from the press shop in a short time so beat up it's almost unrecognizable. This isn't true of plastic dies.

But six factors besides toughness must be taken into consideration in selecting the right plastic tool for a specific job: dimensional stability, shrinkage, weight, labor cost, material cost, strength.

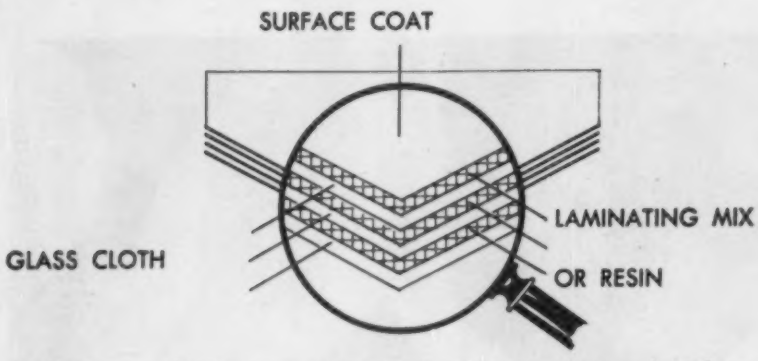
Basically, plastic tools are constructed in four ways—laminated, surface cast, mass cast, and from paste materials. The comparative merits of these four building methods with reference to the seven selection factors mentioned above are rated in the accompanying table, which of course serves only as a general guide. Specific plant or application conditions may alter these factors.

DESIRABILITY FACTORS

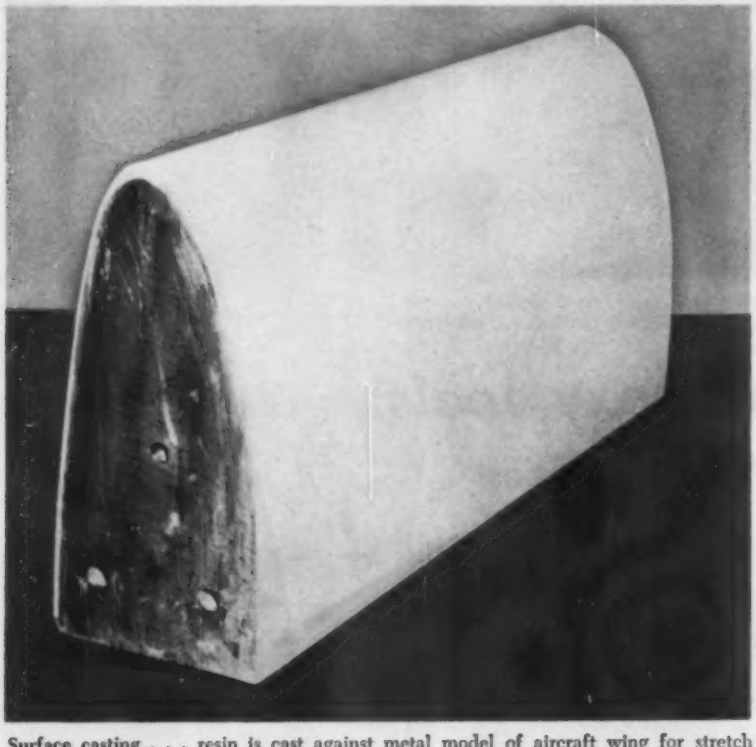
	Laminate	Metal Core Surface Cast	Mass Cast	Paste
Dimensional stability	1	3	4	2
Shrinkage (during cure)	1	3	4	2
Least weight	1	4	3	2
Labor Cost	4	3	1	2
Material cost (per lb.)	4	3	1	2
Strength	1	2	3	4
Toughness	1	2	4	3

Plastic casts or laminates may be made from wood, plaster, plastic, or metal patterns, provided the pattern surface is properly prepared.

• **Wood pattern** surfaces (already finished with a lacquer sealer) should, for example, (1) be cleaned thoroughly with acetone, alcohol, or commercial solvent, then (2) a high-grade, carnuba-base paste wax should be applied and wiped off with a lintfree cloth. Then (3) coats of parting agent should be brushed or sprayed on, and (4) when the surface is dry, paste wax should be applied and wiped off with lint-free cloth.



Lamination . . . alternate layers of glass cloth and resin are built up behind surface coat. Advantage—strength, toughness



Surface casting . . . resin is cast against metal model of aircraft wing for stretch forming. Advantage—strong, solid

• **Plaster patterns** (made from any commonly used plaster) should first be sealed with lacquer and let dry, then the same procedure as (2), (3), and (4) for wood models should be followed.

• **Plastic pattern** procedure is the same, except that no lacquer sealer is needed.

• **Metal patterns with a machined finish** require that all surface dirt be removed first. Then three coats of carnuba-base paste wax should be applied, and rubbed out with lint-free cloth between coats.

• **Metal patterns with unmachined finish** also first require removal of all surface dirt. Then carnuba-base paste wax should be applied and excess wiped with lint-free cloth. Next comes one brush coat or three light spray coats of parting agent. After this dries, a coat of paste wax should be applied and excess wiped off.

With mold properly prepared, here are the basic steps to follow in each of the four methods of building plastic tools:

Laminated tools

Apply to the model (pattern) a surface coat plastic, according to instructions provided by the plastic supplier. When surface coat has become "tack-free," use a "glass paste" mixture to fill such sharp corners and detail as might cause voids or bubbles under the first layer of glass cloth. The glass paste mixture may be made of a laminating plastic mixed with chopped glass fibers and flock.

Apply alternate layers of laminating resin and glass cloth until the desired thickness is completed. Do not apply more than 18 layers (¾ in. thick) at any one time, because the heat generated by the plastic can cause excessive shrink or warp in the finished tool. If a framework is to be added to the laminated tool facing, this should be done immediately after laminating, before removing the plastic tool from the model.

As a general rule, wait at least six hours after the last liquid plastic has been applied to the tool before removing it from the model. Framework is best made of materials exactly like the tool facing. Temperature change, moisture, age, and weight could all affect a plastic tool having a framework made of materials dissimliar to the laminated tool facing.

Surface cast tools

Three different methods have proved successful in doing surface-casting work:

• **Pour Method**—The core is suspended over the die model, and sealed around the edges, then plastic is poured through spouts or at an open end. (Core is usually elevated at one end).

• **Squash Method**—Liquid or paste plastic is placed on the die model, and the core is placed on the material and allowed to settle to a predetermined position.

• **Pressure Pot Method**—Core is suspended over the die model and sealed around the edges. Liquid is then forced into place at low point and allowed to vent at high points.

Depending upon the surface-cast method to be used, set up the core and die model for the casting operation. It is usually advisable to try the core in the mold before the resin is added, especially when the squash method is being considered.

Check the setup to see if air could be trapped by the casting plastic as it enters the mold. Drill vent holes through the core in these areas or elevate one end. Always have the core on top of the die model, because this will keep any small air bubbles away from the working surface of the tool. When pouring into

the mold, allow a steady stream of material to flow until the complete cast is finished. Changing position of the pouring may entrap air.

Mass-cast tools

Mass casting instructions are comparatively simple. When the mold has been prepared, pour the required amount of material into the cavity, allow it to cure, and then remove from the mold. When an unusually large mass is being poured (more than 6 in. thick), it is often desirable to add a filler such as sand and gravel, glass balls, volcanic ash, pumice, cork, or ground nut shells.

This prevents a high exotherm and greatly reduces the amount of shrinkage during cure. Although the simplicity of this method would seem to offer the greatest saving in time and material, its greatest disadvantage is the low strength properties of most mass casting materials. High shrinkage because of heat generated in curing is another disadvantage, although this is being minimized by newly-developed formulations.

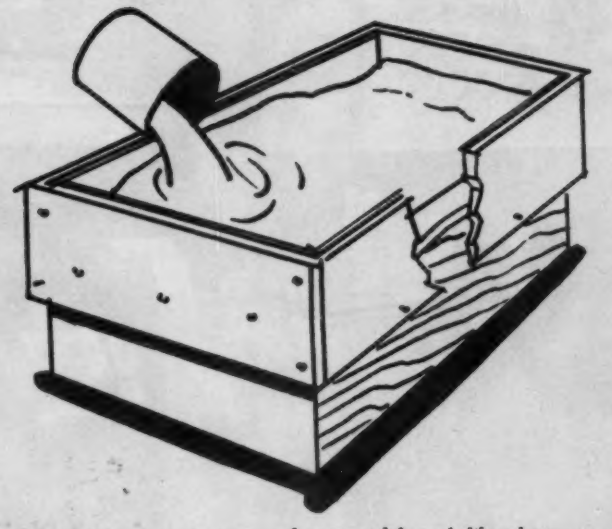
Paste plastic tools

The principal advantage of paste plastic is that it is a non-flowing material. It can be applied to vertical surfaces, does not have to be cast to a level surface (as liquid plastic does), and does not have to be retained in position with special equipment.

One of its principal uses has been in the making of splined masters, particularly in the aircraft industry. Splining, although hard to explain in writing, is not as difficult nor as complicated as the written instructions make it seem.

The first assumption in constructing a spline master model is that accuracy is of prime importance. The base structure is the foundation of the model and must be accurate, stable, and self-supporting. Templets for this type of tool construction are held in a common plane, usually perpendicular to the base and on a reference line established on the base plane.

A complete series of templets makes up the desired three-dimensional surface. Once the template setup is completed, strips of ⅛-in.-sq-mesh galvanized hardware cloth are cut to fit the spaces between the templets. Rods are slid into predrilled holes in the templets and the wire cloth pulled up behind the rods and attached with "hog rings" or wire ties.



Mass casting . . . resin is poured over model much like plaster or Kirksite. Advantage—low cost for labor, material

A base coat of non-flowing paste plastic is applied to cover the rods and wire cloth. When this coat hardens, a second application of base coat is applied, filling each space up to the templet edges. A slab of hard rubber cleans the templet edges and removes enough plastic so that the cured surface of the second application will be approximately 1/32 in. below the templet edges.

When this coat hardens, a finish coat is applied in the same general way as before, using spring-steel spline tools for removing excess material. Three or four such coats may be required to complete the master. By having the spline tool touch three or more adjacent templets, exact dimensions of compound arcs and curves are maintained.

Comparing the systems

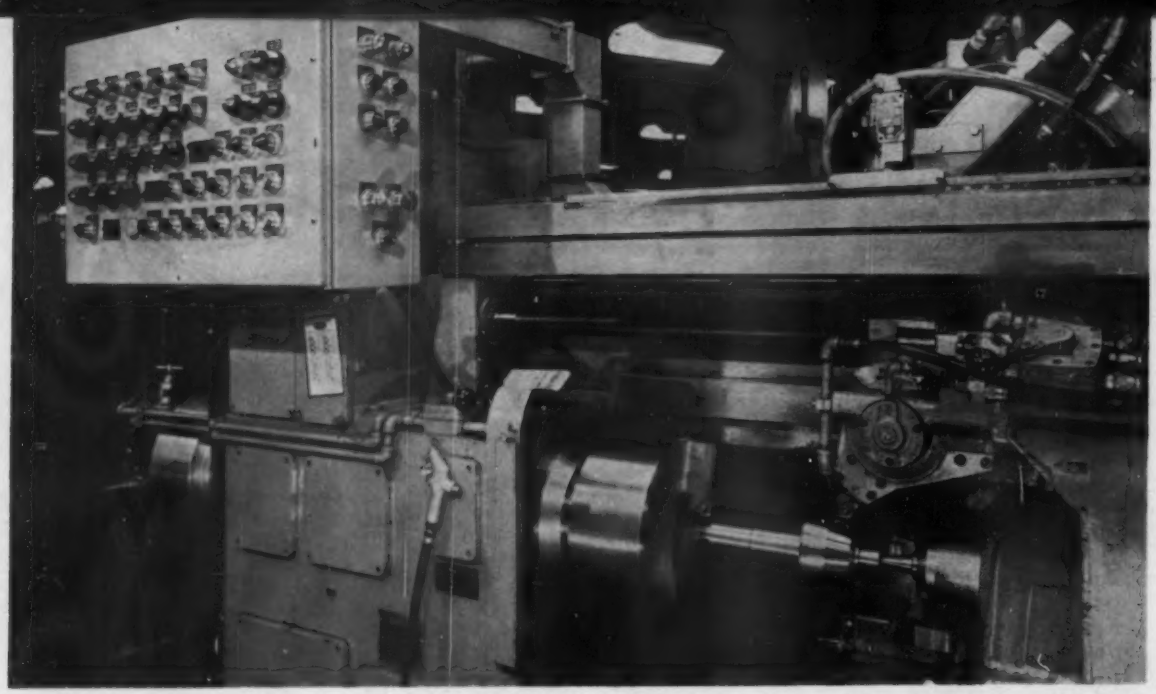
Laminated plastic tools are used wherever accuracy, strength, and weight are prime considerations. They possess the best dimensional stability and are widely used in industry for gage tools, checking fixtures, and inspection fixtures. Laminated plastic drill fixtures, for instance, cannot be surpassed for accuracy, cost, or time to build. They are lightweight, durable, and will not rust or warp with age.

Surface-cast tools have found general use in many industries for metalforming dies. In the foundry industry, the surface-cast method has proved acceptable for making patterns or core boxes. The dimensional stability of surface-cast tools is somewhat less than that of laminated tools, but sufficient for these uses.

Mass castings of plastics usually are used where a large tool surface is invloved, such as an aircraft stretch block or hammer form. Here a material is required which will provide good physical properties, is relatively inexpensive to use, and can be cast in large sections up to 24 in. thick. A plastic casting weighs approximately one-third as much as steel or Kirksite. Recent developments in mass casting materials have improved their physical properties (notably toughness) and have given this method a wider range of usefulness.

Tool made with paste plastics are used extensively in the aircraft industry to produce permanently accurate splined master models. Pattern shops use paste plastics in small- and medium-size foundry patterns. Other industries find these materials useful for Keller models, nesting fixtures, and for repairing spinning blocks, hammer forms, wood patterns, etc. The dimensional stability of tools made of paste plastics is slightly less than that of laminated tools but is well within the working tolerances generally encountered in the metalworking industry.

Although plastic tooling has taken giant strides in the past decade, it is still in its infancy. The future of epoxy plastic tooling materials is yet to come. And, perhaps soon in that future, people will quit bouncing their hammers on plastic dies—they'll already know the hammer will bounce.



Gear end of stem pinion is turned on second automatic lathe, after stem end is complete. Complete cycle includes a potentiometer-controlled roughing cut plus by a templet-controlled bias trace and a finish trace from the same templet

Rough with multiple tools . . . Tracer-contour with a single-point tool . . . Finish turn to eliminate green grinding . . . Dial dimensions . . . Push a button . . . Stem-pinion gears are completed automatically as . . .

Self-controlled lathe saves setup time

Short-run tooling can be a real problem if 30 different parts must compete for turning time on just four lathes. It means that at least one of the lathes is down for changeover at any given time, and that adds up to high production costs and wasted time in any shop.

Cleveland's White Motor Co battled this problem in turning stem-pinion gears for rear axles of a wide variety of trucks. Adding to the complexity of the job: Dimensional accuracies had to be held to such a degree that "green" grinding had to follow all turning operations.

White took the problem to Seneca Falls Machine Co. Together, they not only licked short-run tooling difficulties but came up with more accurate machining and a substantial reduction in materials handling time.

At the time, Seneca Falls was known to have been applying electromechanical control systems to its automatic lathes. With these systems, machine operators could change tooling setups by dialing new cut-lengths and diameters on a panel furnished with the lathes. White adopted this "machine management" system, has since cut setup time for changeover from one pinion to another from several hours to about 10 minutes.

White now turns stem pinions on two Seneca Falls Model LQ automatic tracer lathes. One performs all turning operations on the stem end, the other completes turning of the gear end. Once the stem pinions are mounted between centers, the entire operation is automatic.

Turning stem ends

Operator loads the stem pinions between centers, then sets required cut lengths and diameters on the control board. "On cycle" lights in the top row of the panel indicate which phase of the turning cycle is operating. The first row of dials (below the lights) controls the start position of each pass. The row of dials beneath that determines carriage position at the end of the cut.

All dials are calibrated in inches of carriage travel. The bottom dial reading determines the depth of diameter cut by the tracer tool.

Then in sequence:

- Operator presses start button to advance roughing tools mounted on the rear tool carriage (start and stop positions are dialed in on the panel: depth of cut is cam-controlled). At the end of the roughing pass, tools retract automatically, and the carriage returns to start position.
- Machine automatically switches to tracer control from the overhead carriage, and the second pass begins. This pass incorporates potentiometer control and "bias" control—so that the machine not only works from the finish-dimension templet, but leaves an exact, predetermined amount of stock above the actual finish dimension. This latter (bias) pass leaves 0.060 inches of stock to be removed in the final pass.

This third and final pass, tracer-controlled throughout, turns the stem end to finished-print dimensions. When the pass is completed, the carriage returns to "home" and the

spindle stops. Work is then removed, and the lathe is ready for reloading.

Turning gear ends

A second Seneca Falls automatic LQ lathe turns the gear end of the stem pinion. Although dimensions are different from those of stem ends, the principle of operation is the same. The complete cycle includes a potentiometer-controlled roughing cut, followed by a templet-controlled bias trace, and a final templet-controlled finish trace.

Potentiometers control the initial multiple-tool roughing cut, using the rear tool block, for longitudinal movement. Tracer-carriage position is controlled by automatic comparison of two precision potentiometers. One is located at the control panel. Its output voltage is determined by a dial setting calibrated in inches of carriage travel. The second oil-immersed potentiometer is connected to the leadscrew by gearing. Voltage output is a function of actual carriage position. Each carriage position produces a unique voltage output.

Dial and carriage potentiometers are interconnected and continuous comparison is made between the output voltage of each. Output voltage is the same only when actual carriage position corresponds to dial setting. If carriage position and dial setting do not correspond, the difference in voltage between the two potentiometers is sensed and the carriage is automatically driven to the "null point" (where carriage position and dial setting correspond) and feed stops. Multiple dial settings may be compared in sequence to control a consecutive series of carriage positions.

Actual physical motion of the carriage is controlled by clutches actuated by voltage phase—positive or negative. Positive phase actuates the forward clutch; negative, the reverse clutch. When the difference between carriage and dial voltage is zero (null point), the clutch is de-energized and the carriage stops. The system provides rapid-traverse approach with automatic switching to feed rate for final carriage position.

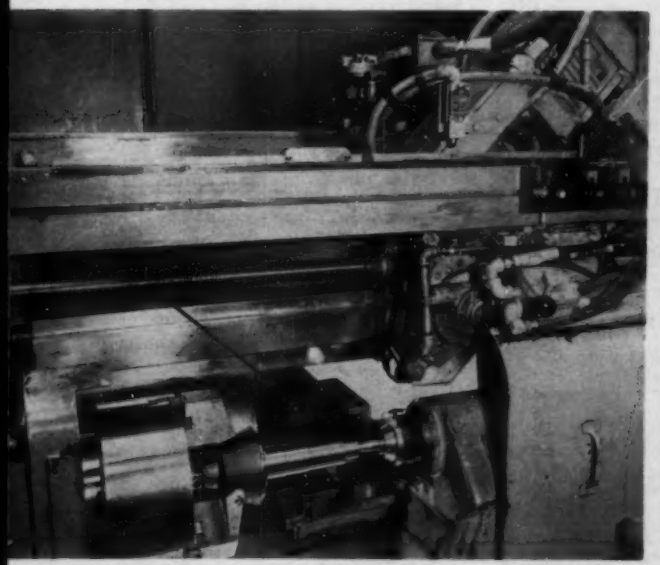
The model LQ tracer unit is an electro-mechanical control system consisting of a stylus which acts as a sensing device, an electric amplifier, a mechanical amplifier for positioning the cross slide, and a master templet.

The stylus housing, mounted on the tool slide, contains a floating stylus which is spring loaded to maintain contact with the templet. As the stylus follows the templet contour, it moves within the housing and causes a voltage output that varies with the position of the stylus within the housing. This amplified output voltage controls the torque and speed of a low-power servo motor. The mechanical amplifier automatically reproduces and magnifies the torque-speed variations, transmitting exact stylus motion to the tracer slide.

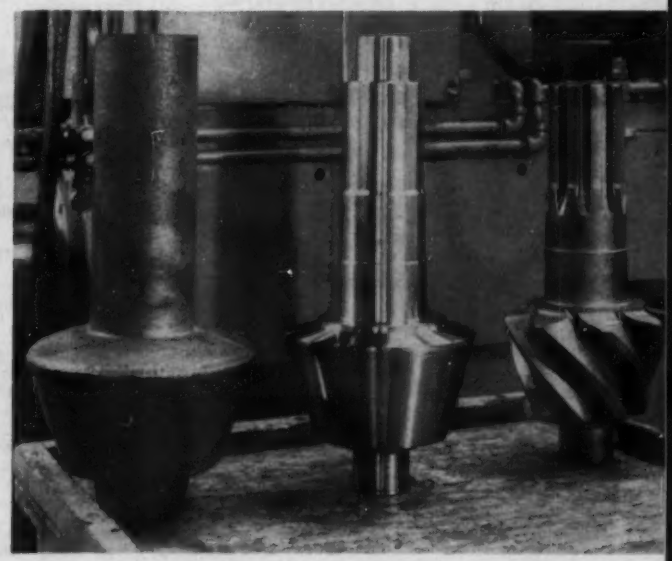
When changeover to a new stem-pinion gear is needed, it is only necessary to change the dial settings to correspond to the new dimensional requirements—and to substitute a new templet for the "bias" and finish cuts. Only one templet is needed to accomplish both rough and finish cuts.

White's engineers, analyzing operations with the new LQ's, report that:

- Setup time has been substantially reduced because of the simplicity of the dial changeover system. Consequently, two machines can now do work previously done by four multiple-tool lathes.
- Close tolerances can be maintained to permit elimination of green grinding.
- A combination of less set-up time, more accuracy and elimination of operations, has almost doubled production of stem-pinion gears.
- All operations for either the stem or gear end can be accomplished on a single machine, hence savings in materials handling have been substantial.
- The automatic chip conveyor keeps the work area clean, and floor space has been freed by reducing the number of lathes.



"Start" and "Stop" positions are dialed in on the panel. Depth of cut is cam controlled. At completion of roughing pass, tools retract automatically, carriage returns to "start" position, and the machine automatically switches to tracer control from the overhead carriage



Stem pinions are turned from forgings on two automatic lathes. Formerly four lathes were required plus a green grinding operation. New installation has doubled production

Job-shop standards

Time

The major part of time formulas for machine-shop operations can now be picked out of a book. Ordinarily, a machine-shop formula may take from one to six months to generate. The new manual can reduce this time to a matter of hours or days.

With the manual, there is no longer any need to go through the tedious, time-consuming task of developing time values for basic work elements. All user has to do is open the manual, pull out standard data already compiled, and add his own shop's variations from the standard.

Called the *Standard Data Manual for a Machine Shop*, the book essentially is a dictionary of every standard hand operation in a job shop. Developed by personnel of H B Maynard & Co, Inc for use in management consulting, the manual is an extension of that company's pioneering work in methods-time measurement. It advances time-study concepts in several important ways:

- **It presents under one cover** enough standard data to make the task of developing time formulas relatively easy.
- **It reduces the cost** of compiling these as much as 50% to 75%.
- **It cuts sharply the time** needed to develop formulas, because large portions of the formulas are already worked out.
- **It simplifies time study.** All the shop need do is add its own variations to the standard data supplied by the manual.
- **It extends the industrial spectrum** of time-formula work. For short-run jobs, even small companies can now apply time formulas.

How it's different

Conventionally, time-study people develop formulas in either of two ways: (1) for a part or group of similar parts (machining of shafts on an engine lathe, for instance); or (2) for a machine or group of machines (operations that, say, similar engine lathes will perform).

Under this procedure, each different machine tool for which a chart is developed has its own individual identity. Thus the time-study man must start practically from zero each time he develops a new formula. It's no wonder that a conventional machine-shop formula can take months to develop.

More than a decade ago, our

WHAT IS M-T-M?

Officially published in 1948, the methods-time measurement system of time values breaks down any manual operation into the basic motions required to perform it. To each basic motion is assigned a predetermined time standard, determined by the type of motion and the conditions under which the motion is made. Unit of time (one hundred-thousandth of an hour) is called a Time-Measurment Unit (TMU).

M-T-M divides human motion into such actions as reaching for, moving, turning, grasping, and positioning a tool or part. Research gives a time standard, expressed in TMU's, for each of these motions. Totaling TMU's for all basic motions in an operation gives an estimated standard time formula.

Because time estimates are predetermined by research (not necessarily performed at the machine) the traditional stop watch is not needed. Here the emphasis is not on an individual machine or part, but on the basic divisions of work itself—loading, clamping, gaging, processing, and so forth.

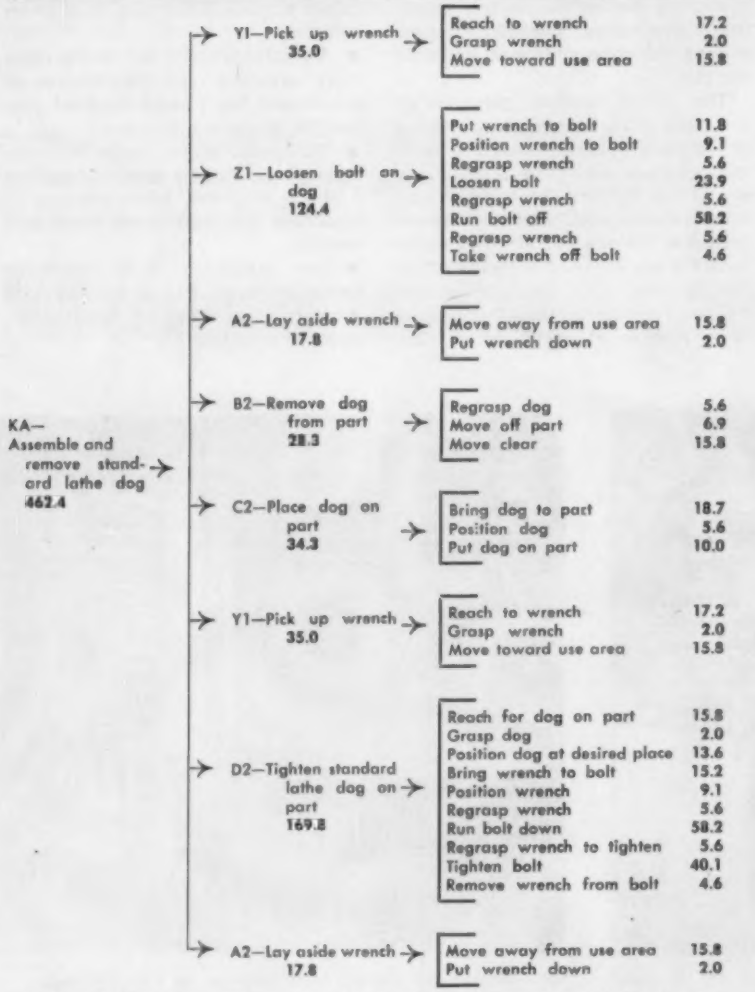


Fig. 1—Basic M-T-M technique is to break down an operation into the basic motions required to perform it. Here an operator makes 34 separate motions to assemble and remove a lathe dog. Formerly, the time-study man had to analyze all 34 motions. The new manual does this job for him

come quicker, cheaper with new...

formulas by the book

By W K Hodson, vice president, and Klaus H Nincke, senior staff consultant, H B Maynard & Co, Inc, Pittsburgh, Pa

work in methods-time measurement challenged this approach. Instead of considering each machine or part individually, this new concept concentrated on the basic divisions of work itself—the handling, clamping, processing, and other efforts needed to do a machining operation. With M-T-M, we break down any manual operation into the basic motions required to perform it, then assign a predetermined time standard to each motion. Basic motions in any manual operation include reaching, moving, turning, grasping, positioning, and disengaging.

Fig. 1 shows the basic motions needed to assemble and remove a standard lathe dog. If you count them, you'll find that this operation takes 34 separate motions. To each basic motion we assign a time standard, expressed in time-measurement unit (one TMU equals one hundred-thousandth of an hour, or 0.0006 min).

How does the new manual fit into the picture? In this way: It gives you, at a glance, the total TMU's needed to perform a standard operation like assembling and removing a lathe dog. Now, instead of having to develop 34 TMU standards for this operation, you simply enter the manual and get the total TMU's (462.4) that are the standard for the operation. If conditions in your shop vary from the standard, you have only to develop TMU standards for the basic motions that make your operation different, then add them to the total given in the manual. As you can see, the savings in time are considerable.

What it does

When we analyze the components of a conventional time formula, we find that practically all machine-tool operations can be covered by only *five* formulas: (1) part handling, (2) part clamping, (3) machine handling, (4) process time, and (5) miscellaneous charts.

Further analysis shows that these formulas (especially No. 1, 2, 3, and 5) can be combined in one manual. In its present form, the manual covers the basic contents of a time formula:

1. Part handling
2. Part clamping
3. Machine handling for the most common machine tools
4. Part gaging
5. Part cleaning and coolant application

With this coverage, the manual is quite universal in its application. Although the manual at present does not contain charts on process time, work is now in progress to include this formula.

The manual, then, considers the primary operation required to produce a part, *regardless of machine*. It also includes the operations required to manipulate the standard machine tools found in most job shops—grinding machines, radial drills, engine and turret lathes, horizontal milling machines, and spindle drillpresses.

Although "job shop" is an ambiguous term, it does characterize a certain type of machine shop. Proved-in-practice job-shop formulas, which have provided the users with accurate standards over a number of years, are the basis for the charts in the manual. We have analyzed these formulas and their motion patterns; the result is a group of patterns that reflects average conditions in job-shop work.

It's true that motion patterns reflecting average conditions can lead to discrepancies when applied to a specific machine tool. Time variations in work elements, or differences in machine and work-area layouts, are of great importance (especially when the part produced is highly repetitive). But where there are "job shop" conditions, motion patterns developed for a given machine tool already consider average conditions for that machine tool. Attempting to eliminate the average concept here wouldn't be economical.

Further analysis will show that variations in patterns of a specific machine tool are no greater or less than the patterns for several similar or dissimilar machines. Hence we developed an over-all average pattern for all elements common to a group of machine tools. This "average" concept in the development of motion patterns tends to level out variations, so that (properly applied) no major inequity occurs.

What it contains

The manual has three separate divisions, each concerned with elements of standard time formulas:

Part One: Primary operations required to make a part, regardless of machine. Here are leveled times for "part control," defined as all manual acts performed to hold a part for machining and to maintain the part's quality. These manual acts fall into four categories:

1. Load and unload part: This section deals with placing a part on a bench or in a machine before clamping, as well as removing the part after the machining cycle and the release of holding mechanisms. Data here assume that part handling is dependent on three variables:

ADDITIVES TO INDIVIDUAL PART LOADING AND UNLOADING

Description of Additive	Reference Symbol	Time in TMU
Assemble and remove regular standard lathe dog	KA	462.4
Assemble and remove cam grip dog	KB	120.1
Assemble and remove arbor — parts to 25# mallet used	KC	880.0
Assemble and remove arbor — parts to 25# hand press used	KD	755.6
Load bar stock and remove stub end hand lift	KE	664.7 ÷ Pcs/bar
Load bar stock and remove stub end — jib crane lift	KF	2908.8 ÷ Pcs/bar

Fig. 2—Typical manual chart shows total TMU's required to perform six different loading and unloading operations. Note that total for first entry is the sum of TMU's for the 34 basic motions shown in Fig. 1. With the manual, the M-T--M specialist gets this total in a matter of seconds, instead of having to total all 34 basic motions

weight, location in relation to bench or machine, and how the part is held during the operating cycle.

2. Clamp and unclamp part: Here are charts that give clamping times for standard holding devices used in machine shops—vises, chucks, table clamps, bolts, handwheels, thumb screws, cam clamps, C-clamps.

3. Apply coolant, remove foreign matter: This section considers such operations as removing chips from a part, table, or fixture; and applying coolant to a part by brush or by releasing a valve.

4. Gage the part: This section shows average times allowed for gaging a part with such instruments as micrometers, scales, plug gages, calipers, vernier calipers, and thread gages.

(Fig. 2 is a typical chart from Part One of the manual.)

Part Two: Operations more closely related to machine tools. This second major division of the manual presents, in three sections, standard TMU's for the following:

1. Elements common to all machine tools. Here are charts that give times for lever, crank, push-button, and switching operations.

2. Operations identified with specific machine tools. Separate chapters here cover the following machines: spindle drillpress, radial drillpress, horizontal milling machine, vertical milling machine, boring mill, engine lathe, turret lathe, cylindrical grinder, centerless grinder, shaper, and the like.

3. Suggested feeds and speeds.

(Fig. 3, a typical chart from this section, shows the TMU's for raising or lowering the arm of a radial drillpress under a variety of conditions.)

Part Three: Motion patterns developed for all the elements used in the manual. This final major division of the manual lists each motion pattern, under the Methods Time Measurement system, that is a part of any standard time given in the first two divisions of the manual. Fig. 4 shows a typical page.

How to use it

You can apply the information in the *Standard Data Manual* in either of two ways:

1. It can be a source of standard data from which to build a time formula. Here the time formula is self-contained, the manual being used only as a source of material from which to copy desired data.

2. It can be a source of standard data to build up worksheets from which standard times will be set. Time data on the worksheet can be referenced to the manual directly, eliminating the copying of elements and the synthesis of these elements. Data included on the worksheet, but not taken from the manual, may be developed by M-T-M procedures.

Selection of the best method depends on whether or not the manual's charts are entirely applicable, with no minor adjustments to suit shop conditions. If no adjustments are necessary, and the data provide sufficient coverage, then procedure No. 2 is best. If the reverse is true, then procedure No. 1 is preferable.

What is the best approach to developing a time formula with the manual? The following outline will help you to generate accurate job-shop formulas:

1. Analyze the operation to be covered, to find (a) coverage desired, (b) equipment variations, (c) basic operations performed by the operator, according to terminology of the manual's charts, and (d) basic operations not covered by manual.

2. Select operations from the manual that are applicable and required. Record reference to the manual on a separate sheet for future use.

3. Develop motion patterns, in TMU's, for elements not covered by the manual.

4. Develop process time charts—such as cutting time and crane time—if needed.

5. Develop worksheet that combines manual times and those not covered by the manual. Make sure that proper references symbols are recorded on the worksheet, to permit proper back checking. Also record any additions of developed elements to manual elements.

6. Check standards developed from worksheet and process charts.

7. Prepare the formula report. Copy required elements from the manual, as indicated on the reference sheet prepared in step 2 and from manual syntheses. Then add elements developed for the formula, making sure that element reference symbols do not duplicate those copied from the manual. Finally, prepare the balance of the report.

RAISE OR LOWER ARM ON RADIAL DRILLPRESS

Arm Speed In Ft/Min	Time Per Occurrence Based on Distance Raised — Distance Raised or Lowered									
	3"	6"	9"	12"	15"	18"	21"	24"	30"	36"
1	624.8	1038.8	1452.8	1866.8	2280.8	2694.8	3108.8	3522.8	4350.8	5178.8
2	420.8	630.8	840.8	1050.8	1260.8	1470.8	1680.8	1890.8	2310.8	2730.8
3	348.8	486.8	624.8	762.8	900.8	1038.8	1176.8	1314.8	1590.8	1866.8
4	325.8	430.8	535.8	640.8	745.8	850.8	955.8	1060.8	1270.8	1480.8
5	294.8	378.8	462.8	546.8	630.8	714.8	798.8	882.8	1050.8	1218.8
6	280.8	350.8	420.8	490.8	560.8	630.8	700.8	777.8	910.8	1050.8
7	272.0	333.2	394.4	455.6	516.8	578.0	639.2	700.4	822.8	945.2
8	263.0	315.2	367.4	419.6	471.8	524.0	576.2	628.4	732.8	837.2

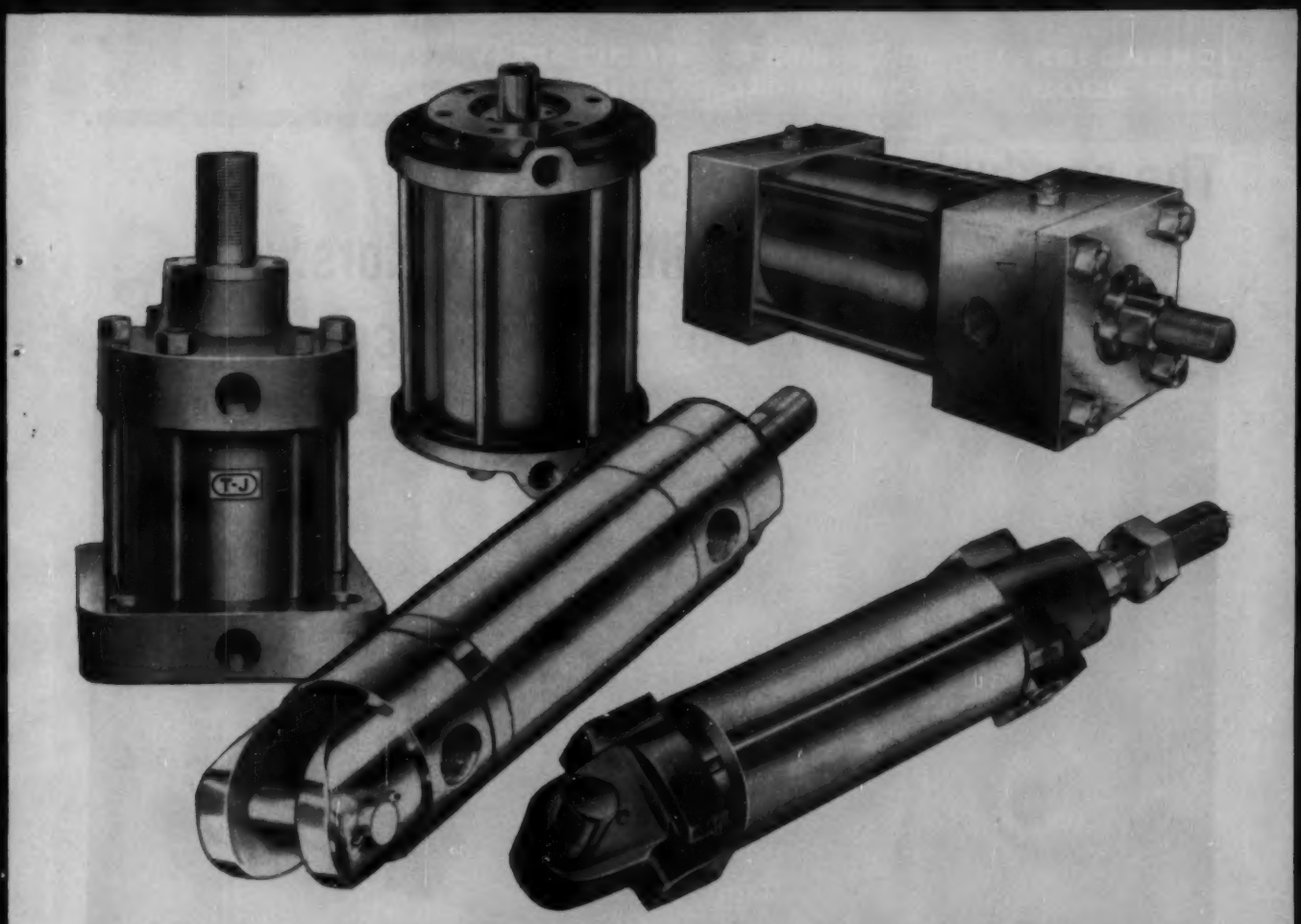
Fig. 3—Operations for specific machines are covered in the manual. Each TMU listed in the above chart is the total of many smaller TMU's for basic motions involved in raising or lowering the arm on a radial drillpress. Chart includes time to obtain control of lever, engage lever, machine time to raise or lower arm, disengage lever, and for operator to return to work position

METHODS ANALYSIS CHART

Description – Left Hand	No.	LH	TMU	RH	No.	Description – Right Hand
Y1 Pick up wrench or aux tools required in normal cycle operation						
			17.2	R18B		Reach to wrench
			2.0	G1A		Grasp wrench
			15.8	M16B		Move toward use area
			35.0			
Z1 Loosen bolt or set screw on standard lathe dog						
To dog on part		R8B	11.8	M8C		Wrench to bolt or screw
Grasp		G1A	9.1	Plsse		Pos. wrench to bolt or scr.
			5.6	G2		Regrasp
			16.2	AP1		Loosen bolt or screw
			7.7	M4B10		N.S.
			5.6	G2		Regrasp
			58.2	5C3		Run bolt or scr. out crnk act.
			5.6	G2		Regrasp wrench
			4.6	M2B		Wrench off
			124.4			
A2 Lay aside wrench or aux. tools required in normal cycle run						
			15.8	M16B		
			2.0	RL1		
			17.8			
B2 Remove standard lathe dog from part						
Regrasp dog		G2	5.6			
Move off part		M4B	6.9	R16E		Toward next operation
Move clear		M16B	15.8			
			28.3			

Fig. 4—Basic motions that go into all elements in the manual are also included in chart form. Reproduced above is a chart showing a portion of the basic motions required to assemble and remove a lathe dog

CIRCLE 251 READER SERVICE CARD ▶



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REFERENCE BOOK SHEET

How to Work Zirconium—I

By G G Grimes, The Carborundum Metals Co Div, The Carborundum Co, Akron, N Y

Severe corrosion problems, especially in chemical processing equipment, are being solved by use of zirconium. Products made of this metal now include pump casings and impellers, eductor nozzles, agitators, shaft seals, tanks, and valves.

Zirconium is readily fabricated with conventional equipment. It can be forged, hot or cold rolled, bent, welded, machined and extruded without difficulty.

Flow purge welding chamber is used during welding of zirconium tubes to zirconium tube sheet veneer.

Mill Products

Multiple vacuum-melted ingots of 12 to 16-in. dia are produced, weighing from 1000 to 2500 lb. These ingots are forged or cogged at 1450 to 1775 F on standard equipment. Care must be taken to condition billets by grinding or blasting. The material may then be finish rolled to hot or cold-rolled sheet, plate, strip or bar product.

Annealing of hot-rolled products is carried out in neutral or slightly oxidizing atmosphere at approximately 1450 F for 20 min. at temperature. Vacuum annealing is normally performed on cold-rolled products to regain ductility without oxidation of the metal surface. Cleaning means for hot-rolled product is normally a grit blast to remove the oxide, followed by a nitric-hydrofluoric acid pickle to brighten the surface.

Further work may be put into the material by deep drawing or wire drawing by conventional methods.

Bending and Forming

Zirconium can be bent and formed easily, with standard shop equipment. Like other metals, it has certain characteristics which are the parameters for fabrication. Along with the physical properties shown in the accompanying chart, a major consideration is that zirconium absorbs large amounts of oxygen, hydrogen, and nitrogen at temperatures greater than 1000 F, as sometimes encountered during fabrication.

Sheet and strip zirconium are normally bent on conventional press-brake equipment, using a 5 T bend radius at room temperature. Tighter bend radii may be obtained by applying heat to the work or dies.

Welding

Sound and ductile welds of good appearance are easily made because of the low thermal expansion and low modulus of elasticity of the metal. The high chemical activity requires the use of an inert atmosphere with either a tungsten electrode or a consumable electrode of zirconium wire. Hold-down bars and backing and trailing blocks are recommended for complete exclusion of contaminating gases. A flow-purge welding chamber may be required in extremely difficult welding situations. A zirconium weld properly made will have corrosion resistance and ductility equal to the parent metal.

The difficulty in welding zirconium to other metals can be overcome by fabricating solid zirconium equipment or by lining a base metal with zirconium. Liners are normally fastened to the base metal by mechanical means.

Recent developments in spot and electron beam welding have shown promise.

Machining

Zirconium and its alloys can be readily machined by conventional methods. Metallurgically it resembles its sister element titanium, in many ways, and the same basic machining techniques apply to both. However, it does not have the tendency to alloy itself with the tool material as do titanium alloys.

Three basic considerations may be used for all machining operations on zirconium and its alloys:

1. Slow speeds
2. Heavy feeds
3. A heavy flood of coolant such as Cimcool or Solvac 15-35G.

Care should be taken to minimize very fine chips, because they are pyrophoric in nature. Zirconium exhibits a marked tendency to gall and work harden, and this

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How to Work Zirconium—II

indicates that higher-than-normal clearance angles on tools are needed to penetrate the previously work-hardened surface and cut a clean chip.

Satisfactory results can be obtained with both cemented carbide and high-speed steel tools. However, carbide gives better finishes and higher productivity. Polishing or honing the cutting edges will give the tool added life. Zirconium and its alloys machine to an excellent finish, requiring relatively light horsepower compared to alloy steel. The tool forces required are relatively low.

For shops in which zirconium has not been machined, the following will serve as a starting point until experience with the metal is developed:

Turning

Roughing cuts are best performed with a feed of around 0.020 ipr at 80-100 sfpm to a depth of 0.125 in. The tool geometry should include a 3/16-in. chip breaker, 10° end clearance, and 1/32-in. nose radius. Finishing cuts can be made with the same tool (reground and honed) by reducing the feed to 0.005 ipr, the depth of cut to 0.010—0.040 in. and increasing the speed to 100—150 sfpm. A back rake angle of 15° should be used with clearance angles and side rake of 10°. Sharp tools along with a coolant should also be used.

Milling

Wherever possible zirconium should be climb milled. Cutters should be kept very sharp.

Optimum surface finish and tool life are obtained when the tool is ground with a positive 12 to 15° radial rake angle and clearance and relief angles of 7 to 12°. A negative 6 to 10° primary radial rake along with cutting corners ground to a ⅛ in. x 45° chamfer and a high, spiral flute should also be used. The work should be flooded or sprayed with a coolant to wash all chips away from the tool. Feed can range from 0.002 to 0.010 ipt at 150 to 250 sfpm. Zirconium requires only about 75% of the horsepower required for SAE 1020 CR steel.

Electrical Discharge Machining

Where slight surface contamination of zirconium from the electrode material can be accepted, electrical discharge machining will remove 0.005 cu. in. per min. and leave a 32-rms finish.

Drilling

The standard 118°, thin-webbed drill running at slightly slower than normal speeds (40 to 60 sfm) and a feed of 0.005 to 0.010 ipr gives good results. Use coolant.

Grinding

Silicon-carbide wheels have shown best form-holding properties in surface grinding. Wheel speeds of approximately 3000 sfpm prove most efficient for light infeeds, and speeds to 6000 sfpm for heavier infeeds. The use of straight grinding oil gives best finishes and yield.

Cylindrical grinding at 6000 sfpm offers no problems. Best results in both centerless and internal grinding are obtained with silicon-carbide vitrified wheels applied at conventional speeds.

A coolant in conjunction with rubber-bonded, silicon-carbide wheels offers best results in cut-off. A speed of 5,000 sfpm and a cutting down feed of 5 sec per sq in. of metal have proved most efficient.

In belt grinding, recommended speeds are 2,000 to 3,000 sfpm when low grinding pressures are employed with 50-grit belts and coarser, and to 3,000 to 4,000 sfpm with high grinding pressures and 60-grit and finer belts. Oil coolants are recommended.

Extruding

Extrusion of zirconium is done on standard presses with special die designs. A tendency to seize on the die can be overcome by the use of a suitable lubricant, such as colloidal graphite, or by copper canning of the zirconium billet. Cold extrusion has resulted in improved metallurgical quality and high yields.

Brazing and Soldering

Brazed or soldered joints with strength approaching that of the brazing alloys used are easily attained. Silver or copper may be used as the brazing metal in conjunction with furnace-brazing techniques. Care must be taken to prevent oxidation of the heated area and the amount of brazing metal controlled such as by shimming the joints.

Physical Properties of Zirconium

Atomic number	40
Atomic weight	91.2
Melting point	1845 C.
Crystal structure	Close packed hexagonal to 862 ± 2°C; Body centered cubic above 862 ± 2°C.
Density (20 C)	6.55 g/cm³
	0.237 lb/in³
Specific heat (0-100 C)	0.0659 cal/g/C
Heat of combustion	264.0 Kcal/mol.
Coefficient of linear expansion at 25 C:	
C—Axis	6.15 x 10^{6} cm/C.
A—Axis	5.69 x 10^{6} cm/C.
Thermal conductivity — 25 C	0.050 cal/sec/cm/C.
100 C	0.049 " " " "
300 C	0.045 " " " "
Electrical resistance (25 C)	41-52 u, ohm, cm
Young's modulus (25 C)	13.7 x 10^{6} lb./in.²

Typical Mechanical Properties

(Transverse, 2.0%, hf, 25 C, Hot rolled and annealed)

Ultimate tensile strength	62,000 psi
Yield strength	50,000 psi
Elongation	28%
Reduction in area	45%
Hardness	88-92 R_B

Photo courtesy of Heintz Division—Kelsey Hayes Corporation

Aristoloy meets severe cold extruding requirements on track bushings for Caterpillar Tractor Company

On the backward extrusion of this track bushing a 3 x 5-inch hollow blank is extended to 8 inches in a single blow. For uninterrupted flow of production, chemical and physical uniformity of the material is essential.

On thousands of parts Aristoloy electric furnace steel has fulfilled the stern production requirements of cold extruding.

Controlled melting of selected scrap, careful rolling and precise heat treating and finishing, this is why Aristoloy is so ideally suited to high volume production where rejects caused by material faults and deficiencies can be so costly.

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Maximum Torque for Screws

By John A Stevenson,
The H M Harper Co, Morton Grove, Ill

Source: "Fasteners," Vol. 14, No. 4, published by Industrial Fasteners Institute, 1517 Terminal Tower, Cleveland 13, Ohio

Torquing values for screws made of various materials are offered as a guide. Tests were conducted on dry, or near dry, product. Mating parts were wiped clean of chips. Bolt tension is held at a factor somewhat less than the yield point.

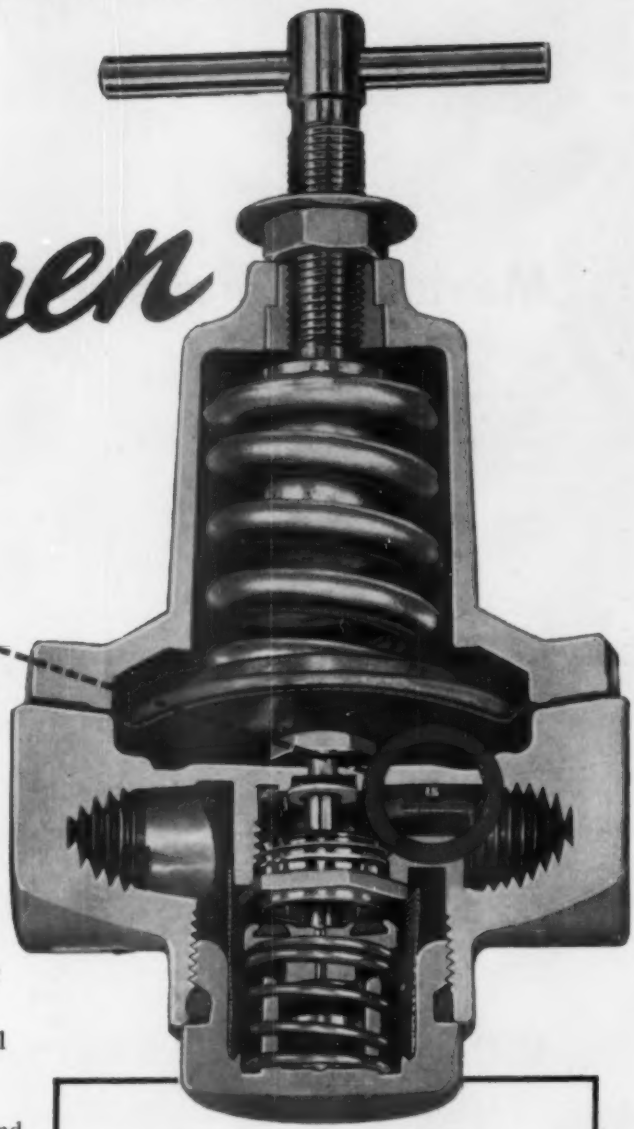
Bolt Size	Low-Carbon Steel	18-8 Stainless	Brass	Silicon Bronze	Aluminum 24ST-4	316 Stainless	Monel
	in.-lb	in.-lb	in.-lb	in.-lb	in.-lb	in.-lb	
2-56	2.2	2.5	2.0	2.3	1.4	2.6	2.5
2-64	2.7	3.0	2.5	2.8	1.7	3.2	3.1
3-48	3.5	3.9	3.2	3.6	2.1	4.0	4.0
3-56	4.0	4.4	3.6	4.1	2.4	4.6	4.5
4-40	4.7	5.2	4.3	4.8	2.9	5.5	5.3
4-48	5.9	6.6	5.4	6.1	3.6	6.9	6.7
5-40	6.9	7.7	6.3	7.1	4.2	8.1	7.8
5-44	8.5	9.4	7.7	8.7	5.1	9.8	9.6
6-32	8.7	9.6	7.9	8.9	5.3	10.1	9.8
6-40	10.9	12.1	9.9	11.2	6.6	12.7	12.3
8-32	17.8	19.8	16.2	18.4	10.8	20.7	20.2
8-36	19.8	22.0	18.0	20.4	12.0	23.0	22.4
10-24	20.8	22.8	18.6	21.2	13.8	23.8	25.9
10-32	29.7	31.7	25.9	29.3	19.2	33.1	34.9
¼-20	65.0	75.2	61.5	68.8	45.6	78.8	85.3
¼-28	90.0	94.0	77.0	87.0	57.0	99.0	106.0
5/16-18	129	132	107	123	80	138	149
5/16-24	139	142	116	131	86	147	160
⅜-16	212	236	192	219	143	247	266
⅜-24	232	259	212	240	157	271	294
7/16-14	338	376	317	349	228	393	427
7/16-20	361	400	327	371	242	418	451
½-13	465	517	422	480	313	542	584
½-20	487	541	443	502	328	565	613
9/16-12	613	682	558	632	413	713	774
9/16-18	668	752	615	697	456	787	855
⅝-11	1000	1110	907	1030	715	1160	1330
⅝-18	1140	1244	1016	1154	798	1301	1482
¾-10	1259	1530	1249	1416	980	1582	1832
¾-16	1230	1490	1220	1382	958	1558	1790
⅞-9	1919	2328	1905	2140	1495	2430	2775
⅞-14	1911	2318	1895	2130	1490	2420	2755
1-8	2832	3440	2815	3185	2205	3595	4130
1-14	2562	3110	2545	2885	1995	3250	3730
	ft-lb	ft-lb	ft-lb	ft-lb	ft-lb	ft-lb	ft-lb
1⅛-7	340	413	337	383	265	432	499
1⅛-12	322	390	318	361	251	408	470
1¼-7	432	523	428	485	336	546	627
1¼-12	396	480	394	447	308	504	575
1⅜-6	732	888	727	822	570	930	1064
1⅜-12	579	703	575	651	450	732	840

All Pressure Regulators are not alike

Norgren

Baffle and Siphon Tube Construction

provides more uniform regulated pressure as flow demand changes



In the ideal pressure regulator there would be no change in the regulated pressure no matter how wide the variations in the flow rate.

Norgren Pressure Regulators approach this ideal by providing a baffle and siphon tube feature. This increases the sensitivity of the valve to changes in the flow rate through the regulator and provides better performance and a more uniform regulated pressure over a wide range of flow rates.

The baffle protects the diaphragm from pressure shock and abrasive action. This gives you longer regulator life, more dependable operation and minimum maintenance.

For complete information on all your regulator needs, ⅛" to 2", call your nearby Norgren Representative listed in your telephone directory- or WRITE FACTORY FOR DESCRIPTIVE LITERATURE.

Norgren Pressure Regulators give you these important features:

- Balanced Valve Construction — improved regulator performance
- Large Nylon-reinforced Buna N Synthetic Rubber Diaphragm — long service life
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- Large Passages and Valve Openings — large flow capacity
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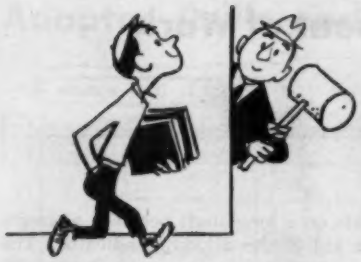
Talking Shop...



Open Season

RECRUITING of engineering graduates-to-be will soon be moving into full swing. While some of the rather unorthodox practices (by both company and student) of a few years back are not likely to be so prevalent, the temptations on both sides will be a little stronger this year than last. If you don't know the ethics of recruiting as endorsed by the Engineers Council for Professional Development, here's how to get a copy: Write for "Recruiting Procedures and Practices" to American Society for Engineering Education, University of Illinois, Urbana, Ill. The price for a single copy is 10¢. You can get 100 for $3.

Plumed Warrier

BELATEDLY WE WANT to comment on the second report on missiles and metals by W D Mogerman, Inco's Corrosion Reporter. In the second installment he reviews the metal problems of missile fuels—fluorine, fuming nitric acid, hydrogen peroxide, and boron. His tales of fluorine bring to mind the havoc wrought when the wax bottle containing the supply in our chemistry lab melted. "There is only one element in this world like fluorine," he comments, "and probably a good thing too."

The title of this item is inspired by his account of the way knights wore ostrich plumes until the grenade came along and bested the knights. Then the grenadiers appropriated the plumes. Today the plumes would have to be mounted, for the moment at least, on the Atlas missile. But maybe they really belong to the people who design and produce metal containers and piping to handle the fuels.

Price Surprise

YOU THINK PRICES always go up? So did we. But the average prices of manufactured goods today are 25.3% less than they were ten years ago relative to the average yearly pay of factory employees. This impressive statistic comes from a study made recently by Eddy-Rucker-Nickels Co, management consultants. We are getting something out of those productivity gains in metalworking after all. Don't forget that this doesn't apply to everything you spend your money for: services and taxes, for example.

Up In Air

LEVITATION is a word we've always associated with what a magician does to his attractive girl assistant before passing a hoop over her body. Now that the National Bureau of Standards has reported an "air bearing," levitation may invade the shop. We might use air bearings to support shafts for precision balancing. There are rumors of a drilling and tapping dynamometer in which the work is on a piston supported by air jets in a cylinder and held away from the cylinder wall by other air jets. Air bearings may also be the answer for machine tools operating at ultra-high speeds.

Goodbye, Chips

A CONTINUOUS metal chip handling and cutting oil recovery system recently installed at Link-Belt's new plant in Indianapolis is reported to be the 19th such installation in the US. The chip conveyors are under the floor, chips are crushed, oil is extracted and the dry chips are loaded into railroad cars. The systems have been installed by Turbine Equipment Co, but Link-Belt must be impressed by No. 19. It has recently acquired the process.

Ultrasonic Note

ANCIENT EGYPTIAN bronzes are the latest objects to succumb to ultrasonic cleaning. The usual cleaning cycle at the British Museum has required about eight months. Now the bronzes are cleaned ultrasonically in a matter of minutes. There are some stubborn particles that remain which must be removed by the old method of extended washing in acid and alkaline baths. The average time is half what it used to be, however.

Dry Run

TAPE-CONTROLLED MILLING machines are run through a dry run at Convair-Ft Worth. A stylus mounted in the machine spindle traces the cutter path on paper as the tape controls the spindle action. This does not test the depth of cut, but it does check the complex profiles where errors are most likely to occur and without causing any scrap.

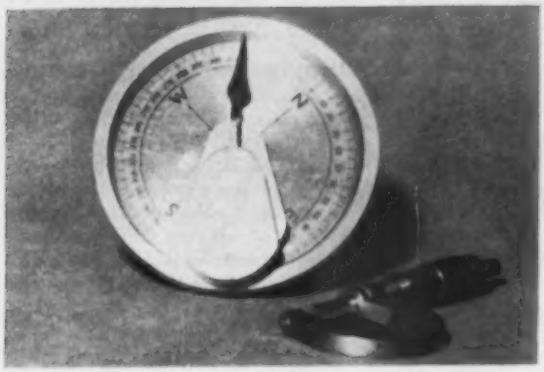
Collapsible

THE FIRST METAL TUBES were used 119 year ago to preserve artist's mixed paints. We're not sure whether these first tubes were produced by the highly efficient impact extrusion process that is now so common, but we do know that artist's paints still come in such tubes. A few years back it looked like squeeze plastics might have collapsible tubes on the run, but not so. Last year their use, already past the *billion* mark, was up 14%. Some patient soul has counted the output at 1,150,013,808. Half were filled with tooth paste.

• 466

Practical Ideas...

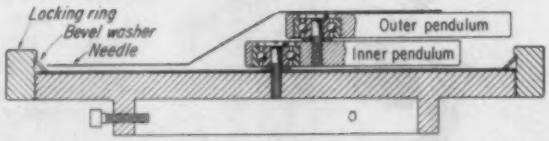
Dividing Dial Assures Accurate Re-Alignment of Work



Here is a tool that can solve difficult positioning problems when a dividing head cannot be used. By attaching it to the end of a workpiece, it establishes a cutting position which it duplicates or alters as required after the work has been shifted.

An example of this is in the machining of a shaft which is to have separate keyways so widely spaced that the shaft must be shifted before all can be completed. This tool, then, makes it a simple operation to relocate the work at the exact radial setting as the previously cut keyways.

But this is by no means the full capacity of the tool. It can also indicate angular settings from the original as, for instance, in cam production where each keyway is cut at a specific angle to the next. Machining squares and flats on a long shaft becomes a simple operation with the aid of the dividing indicator. The only other equipment necessary is a pair of accurate V-blocks keyed into the machine table and straps for securing the work.

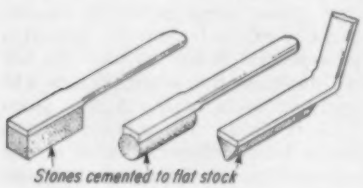


All parts, with the exception of the plastic dial face, are shop made. The 4-in. dial can be purchased at a blueprint shop. The back of the face-plate component is bored to take work up to 2-in. dia and fitted with socket-head mounting screws. A fine thread, machined on the periphery of the face plate, accepts a knurled outer locking ring. This ring, together with a thin level washer, locks the plastic dial in any desired position.

Two pendulums, instead of a single one, are used to increase sensitivity. The inner pendulum has a push fit over a small ball bearing mounted, with a spacer washer, in the center of the face plate. And the outer mounts in the same way on the front side of the inner pendulum.

A sharply-pointed indicator needle is fabricated and bent off set to lie close to the dial face. After the needle has been sweated to the outer-pendulum face, the parts are assembled.

John Chandick, Allentown, Pa



Mounted Honing Stones Are More Efficient

Because some honing stones are by necessity slender, they will invariably become broken during rough handling or excessive pressure. Short pieces are then often discarded as useless, being too short to hold between the fingers. This is totally an unnecessary waste inasmuch as these pieces can be made into tools usually more comfortable to work with, and very often more effective, than the stone in its original shape.

The tools are made by bonding the pieces, after they have been thoroughly degreased, to handle with any of the quick-drying cements available. Handles are cut from flat stock to desired lengths, their gripping ends rounded for comfort, and bent or left straight as required. Three samples are shown at left.

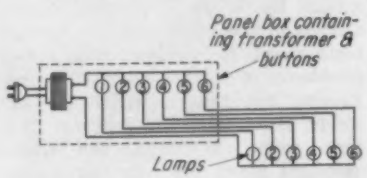
John J Zuber, Pittsfield, Mass

Defective-Work Warning System

Some of the sheet-metal parts produced in our plant require several power presses, each doing an operation, to complete the final product. This means that for each time a part has to be relocated, there is a chance of misalignment even if the operation is closely watched.

It is for this reason that we set up inspection next to the press turning out the finished product. The inspectors job is to check as many parts coming off the press as possible and alert the attendant of the press malfunctioning when a defect is found. This often required him leaving his post when he could not make himself heard over the press noise.

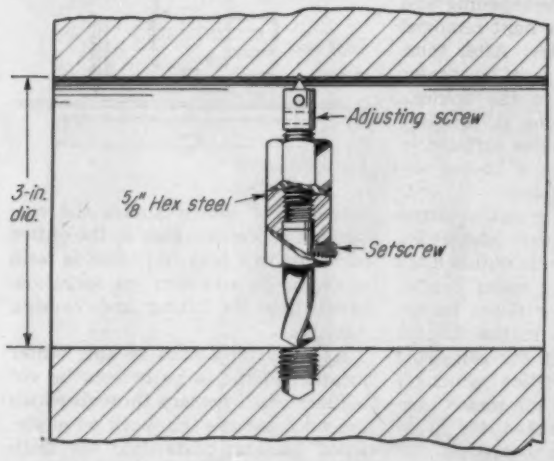
To make the warning and correcting cycle shorter, and more convenient for the operator, we have installed a defect-warning on all the presses usually employed for this work. It consists of a low-voltage circuit, powered by a 6-volt secondary-line transformer. Each press is fitted with a 6-volt bulb, in a reflector with a ruby lens, and wired to its corresponding push button on a panel.



Now, when the inspector finds a defect, he merely presses a button to indicate what machine is not operating properly. The attendant then makes the necessary adjustments to rectify the trouble with a minimum of lost time.

Fred Lettino, Long Island City, NY

Adapter Drills and Taps Holes in Bore



Recently, we had to drill and tap two ½-in. holes opposite each other in the center of 6-in. long, 3-in. dia bore. Both holes had to be blind and we were not permitted to work from the outside into the bore which definitely took the job out of the "easy" category as we weren't equipped for this kind of work.

However, not being easily deterred, we constructed the adapter shown with which we did an excellent job. It consists of a piece of ⅝-in. hexagonal steel tapped at one end to take a pressure-adjusting screw. The extended end of this screw is turned with a concentric center point and drilled with two ⅛-in. tommy-bar holes at right angle to each other.

The other end of the adapter is opened up to accept a ½-in. tap drill which is shortened enough to make the whole assembly slightly less than 3 in. long. A small setscrew, entered through the side of the adapter, bears on a flat on the drill to prevent its rotating.

With the hole locations laid out, the adapter is inserted to rest in the punch marks made. While the adapter is rotated with a wrench, constant pressure is maintained by backing out the adjusting screw, using a short piece of drill rod as tommy bar. After the hole is completed, the drill is replaced with a tap which is similarly shortened and fed into the hole.

Support for the adjusting screw during the drilling and tapping of the second hole can be provided in either of two ways. One is to use a longer adjusting screw which will seat in the bottom of the completed hole. The other way is to plug the hole with a short headless setscrew and use the wrench socket as a guide.

John Rodger, Melbourne, Australia

Indicator Assures Uniform Depth of Center Holes

Quantity production of spindles, arbors, or specialized shafts usually requires that all dimensions be taken from either or both ends. It is then imperative that not only must the stock be faced to identical lengths, but should the work be mounted on centers, the center holes must be of the same depth.

To simplify this job, we devised a method involving a regular spindle stop and an indicator secured to the tailstock quill. Combined, these two components enable us to produce workpieces of identical lengths with center-hole depths within 0.001 in.

This is the way the setup works: After facing off the first piece, the indicator is mounted on a surface gage which in turn is clamped to the tailstock quill. A center hole is started, but before full depth is reached, the indicator is adjusted to barely touch the work. The hole is then completed and the indicator zeroed out—not to be disturbed until all holes have been drilled.

The next step is to turn the piece end-for-end and make sure it rests against a fixed stop in the headstock spindle. When the second end has been faced off to the required workpiece length and lathe-bed stop adjusted, the centerdrill is advanced until indicator reads zero. The setup is now ready to accept subsequent pieces in a one-two-three sequence.

Frank Bachula, Bridgeport, Mich

Fixture Assures Neat Markings

Here is a simple way to get a professional-looking numbering job at a minimum tooling cost; and on a surface that you would have difficulty marking neatly without some aid. It's an ideal method for adding the finishing touches to prototype and research-equipment work which usually runs in small quantities.

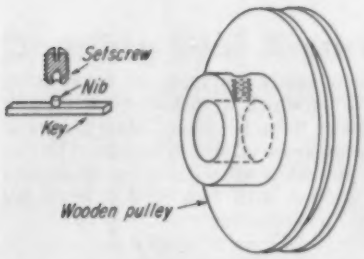
An example of such a job is illustrated. Here it is necessary to mark the graduations on an angular surface of a circular base for a small machine-tool accessory. The machined and graduated casting itself serves as base for the fixture. A support arm, to guide a single numeral stamp, pivots in the central hole of the casting.

Movement of the arm, for proper spacing of the numbers, is indicated by a pointer fastened to its side with two screws. Once the pointer lines up with the location for either a single, double, or triple-digit number, a sharp blow with a small hammer on the stamp inserted makes a neat impression.

The stamps are the same as those used with the stamping jig described in AM—Nov 2, '59 p134. They have been surface ground to fit into the guide-arm slot where they are retained by a flat spring.

HJ Gerber, Stillwater, Okla

Practical Ideas...



Wood as Prototype Material

When testing light mechanical prototype, it is sometimes necessary to make a quick change of pulley diameters on the motor. And because the pulley sizes are purely experimental, and not intended for permanent installation, it's unnecessary to make them of standard stock and by costly machining procedures.

To save time and cost of material, we turn our trial pulleys out of hardwood on a small lathe. These are durable enough for use on fractional HP motors until the proper power transmission is found, at which time the temporary pulley is replaced by one copied in the required material.

An effective method of securing a wooden pulley is first to make a key with a nib projecting on one side. Its width and thickness should be the same as the width and depth of the keyway in the shaft on which the pulley is to be mounted. The nib fits a hole drilled into a headless setscrew inserted in the pulley hub. This is sufficient to drive the pulley as it is also secured endwise; eliminating the need for a keyway in the pulley bore which, incidentally, wouldn't be much good anyway.

H F Spinks, Manchester, England

Die Profile Registered in Solder

Some types of blanking dies, by nature of their construction, make profile transfer to the punch a problem. This is to say that when stamping by such tools is to be anything but straightsided, some gimmick has to be devised since the usual scriber-tracing approach can't be applied.

A simple solution is to coat the punch face with a soft metal into which an impression is made. This is done after the punch blank has been ground to its required length, plus a few thousandths. This is then jotted down as it will be referred to later.

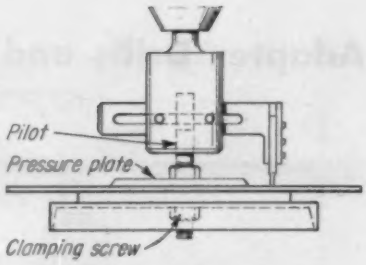
Once the die block has been positioned and secured to its half of the die set, the punch blank is oriented to cover the entire die opening and located. The blank is next removed for coating with solder. After thoroughly cleaning the face, we prefer to heat the blank to the solder's fusion point by placing it, face up, on a heating plate. When sufficiently hot the face is given a liberal deposit of rosin-core solder.

Cooled, the blank is again placed in the surface grinder where the solder is ground down to within 0.010 in. of the previously noted height. An impression is now taken by reinstalling the punch in the die set and carefully closing the set. This produces a clear outline which is followed in finishing the punch profile. Thoroughly checked for fit in the die, the punch is cleared of solder and hardened.

Dominic A Zonfrelli, Medfield, Mass

Circle-Cutter Pilot is also Workholder

Unless time-consuming preparations are made, the disk that a circular cutter produces will sometimes break the tool as it is withdrawn from the work. This is a problem we have solved by replacing the conventional pilot drill with a work-



holder pilot which guides the cutter in a concentric hole in the cutter body. In this way, the disk is held down during and after the operation, preventing its lifting and causing damage.

A pre-drilled hole in the center location of the large hole to be cut is therefore necessary through which the pilot secures the work on a plywood back-up plate onto the drill-press table. But before the nut on the underside of the table can be tightened, the cutter head is entered over the pilot to center it.

With the exception of the center hole, which has been reamed up to accept the pilot in a running fit, the circle cutter is a conventional tool. The other components needed are a pressure plate, slightly smaller than the hole to be cut for added stability, and the pilot. The latter is made of drill rod which is threaded and hardened.

H Koslow, Bronx, NY

Boris Smirnoff
White Plains, NY
Won $25 for his idea:

KNEE MILLER FORMS COILS
in the Dec 28, 1959 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

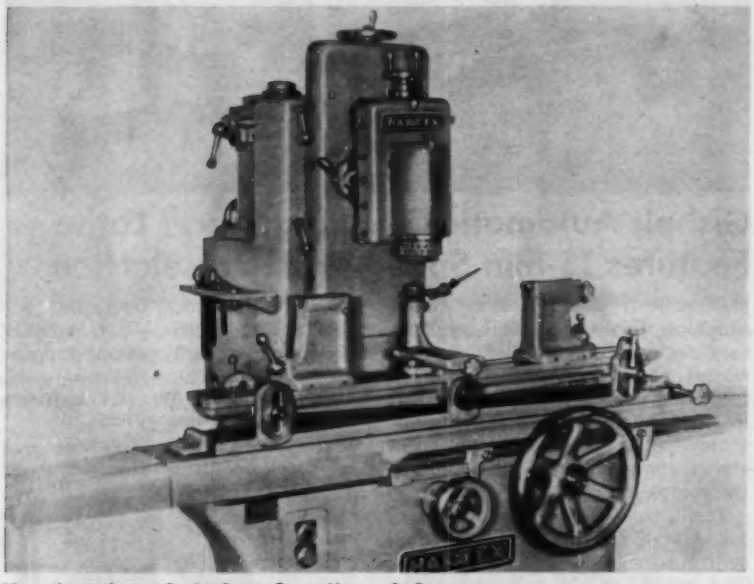
JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

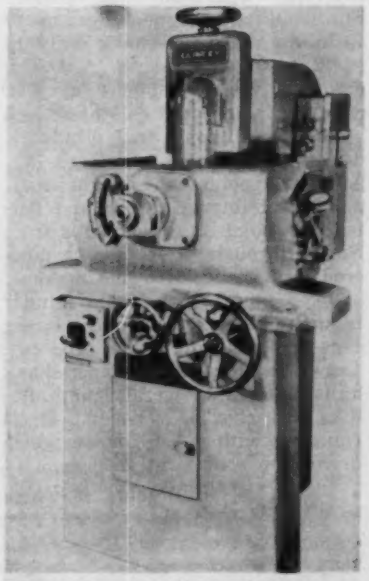
WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

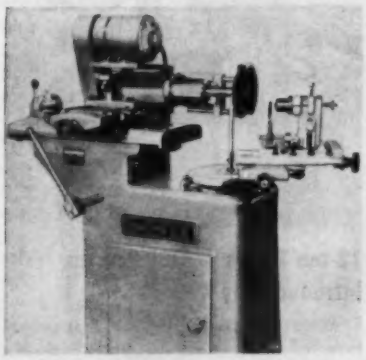
New Shop Equipment
Materials and Parts



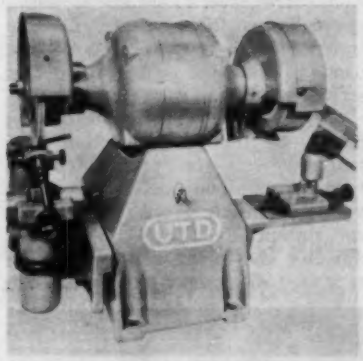
No. 1 universal tool and cutter grinder



No. 2 formed cutter grinder



No. 3 tangent-arc profile grinder



No. 4 multi-point drill grinder

No. 5 tangent-arc profile grinder

Union Twist Drill Introduces Hartex Tool Grinder Line

Line of five tool and cutter grinders includes a universal tool and cutter grinder, formed cutter grinder, multi-point drill grinder and two tangent-arc profile grinders. Designed and developed by the Union Twist Drill Co, they are made in Germany by UTD's Hartex Division.

No. 1 universal tool and cutter grinder grinds clearances on straight or spiral flute cutters, reamers, mills, slitting saws, counterbores and special cutters. Capacity between centers is 12 in. OD by 31 in. long. Spindle is driven at 8000 rpm by a 1-hp motor. Table travel is 29 in. Adjustments include coarse and fine feed for wheel elevation, spindle slide swivel ±10° from vertical, horizontal column movement of 3 in., upper table tilt of ±5°, lower table horizontal swivel of ±4½°.

No. 2 formed cutter grinder is a hand-feed machine for sharpening straight or angular gash cutters with positive rake up to 30°. It features a tub-like one-piece table which reciprocates horizontally on precision roll-equipped ways. Cutter is completely sharpened in one cycle and all teeth are ground true to the axis of the cutter. It handles cutter diameters to 8½ in. and thicknesses

to 3½ in. Spindle is driven at 2430 rpm by a 1½-hp motor.

No. 3 tangent-arc profile grinder is designed for sharpening cutting tools having radii in the cutting surface and for grinding clearances on end mills, milling cutters, counterbores, reamers and multi-diameter cutter gangs. It consists of reciprocating horizontal wheelhead and a revolving workhead. The grinder can handle arbor type cutters up to 10 in. dia and taper shank mills up to 12 in. overall length. A 1/3-hp motor drives the spindle at 4700 rpm. Radius capacity is 5½ in.

No. 4 multi-point drill grinder is designed to grind the standard 118° point, 135° point, split or crankshaft point, web-thinned point, and flatted face point. It grinds drills from No. 50 through ⅝ in. and is powered by a ¼-hp, 3450-rpm motor.

No. 5 tangent-arc profile grinder is similar to No. 3 but with a larger capacity to handle arbor type cutters up to 30 in. dia and taper shank mills up to 18 in. overall length. Radius capacity is 7½ in. It is equipped with a 1-hp motor which drives the spindle at 2600 rpm.

Union Twist Drill Co, Athol, Mass

MORE DATA? Circle 51, inside back cover

Norelco Portable X-Ray Unit Radiographs 3-in. Thick Steel

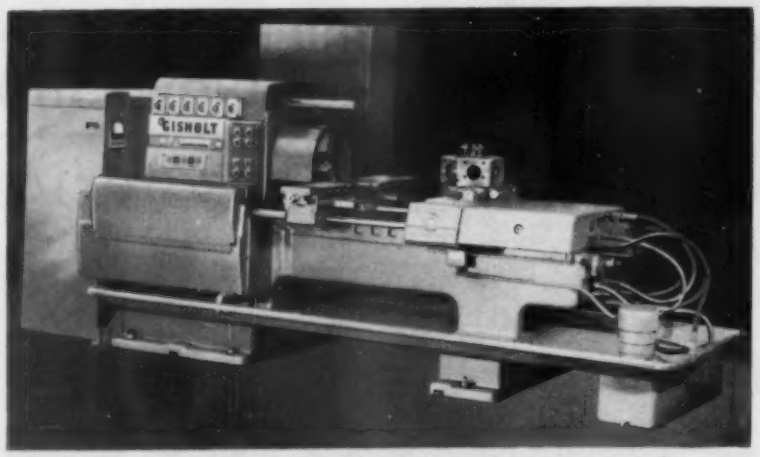
Norelco PG 300 portable industrial X-ray unit is capable of penetrating over 3 inches of steel. Tubehead weighs 231 lbs, the control cabinet 77 lbs.

Emergent beam angle is 10° and focal spot size is 2.3 mm. X-ray voltage is continuously adjustable under load in a stepless range from 65 to 300 kv. Load rating is 5 ma up to 260 kv and 4 ma from 260 to 300 kv. Duty cycle is 100% continuous with water cooling, intermittent with air.

Power requirement is 220 v, 50/60 cycles, 9 amps.

Philips Electronic Instruments, 750 S Fulton Ave, Mt Vernon, NY

MORE DATA? Circle 52, inside back cover

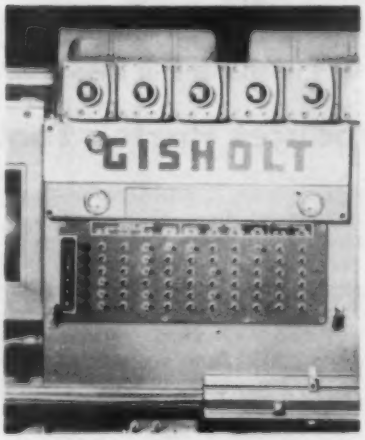


Gisholt Automatic Chucking Turret Lathe Features 15-min Speed, Feed Preselection

Masterline 3F Fastermatic automatic chucking turret lathe combines fast, easy setup with completely automatic operation. On most jobs all feeds and speeds can be preselected in less than 15 minutes. All the operator has to do is chuck the work, start the automatic cycle and remove the completed part.

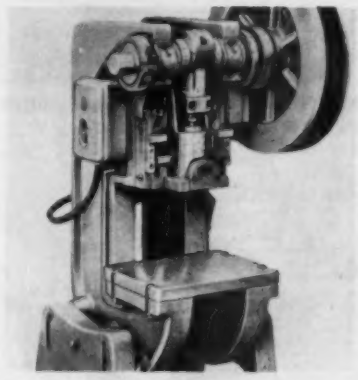
Feeds, speeds, machine functions are preselected on a toggle-switch control panel at the left of the chuck. The panel has six horizontal rows of selector switches, one row for each turret face. There are 10 vertical columns for separate machine functions. Job record sheets can be used to indicate correct selector switch positions for recurring lots.

Above the selector switch control panel are the feed selection controls. Feeds are preselected by turning dials on meter-out-control valves, with one valve for each turret station. Feed rate is infinitely variable and can be set by referring to a feed rate meter mounted at the left of the headstock. Operating controls include cycle start, spindle job, chuck-unchuck, coolant and on-off.



Gisholt Machine Co, 1245 E Washington Ave, Madison 10, Wis

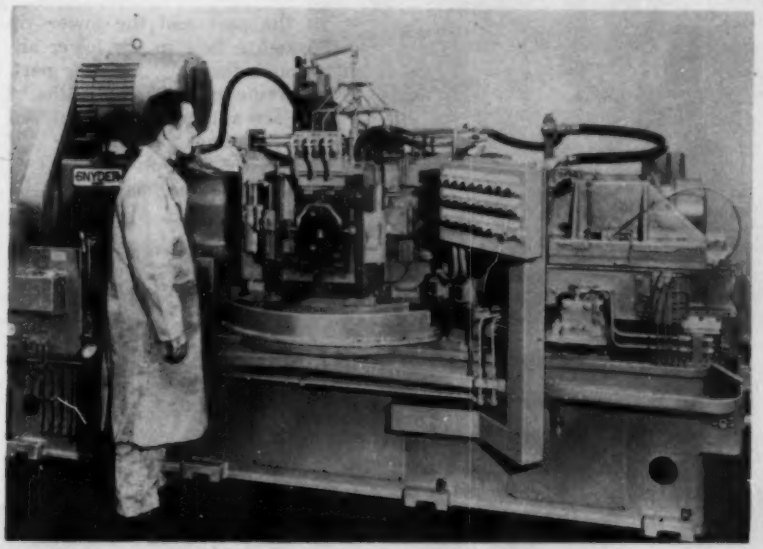
MORE DATA? Circle 53, inside back cover



12-ton Series of OBI Presses Introduced by Kenco

Frames are available in a full selection of shut heights and are designed to be cast free of internal strains, often a limiting factor in heavy castings. Use of balanced ribbing and controlled cooling of sorbitic frame castings in the foundry result in extra high strength and resistance to deflection, substantially increasing die life in service.

Kenco 12-ton series is offered in standard OBI models as well as deep throat and slow speed presses. Electro-Safe presses are also available with built-in control features that give extra effectiveness to overload detectors for safeguarding dies or for ready adaptability of safety



THREE-WAY DIAL INDEX MACHINE mills, drills chamfers and reams malleable iron automobile differential carriers at a rate of 85 pieces per hour. The machine uses cross-feed heads in all work stations—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

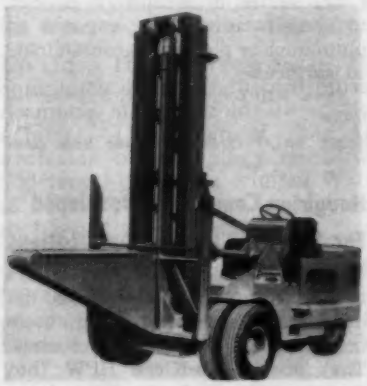
MORE DATA? Circle 54, inside back cover

check monitors in automatic operation. Other standard models are available with Cyclo-Safe clutches which feature maximum safety and durability for either single stroking or continuous operation.

Additional features: crankshafts are one-piece slotless construction for maximum strength; extra long ram guides fully contain the ram at all points of the working stroke; drive mechanism is designed to carry several times the load required by rated tonnage.

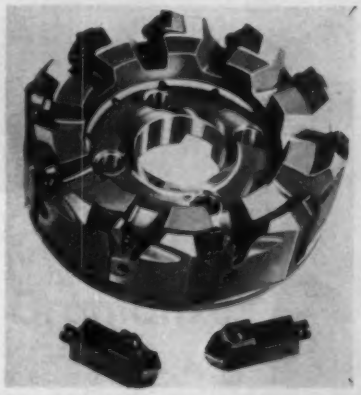
Kenco Mfg Co, 5211 Telegraph Rd, Los Angeles 22, Calif

MORE DATA? Circle 55, inside back cover



HEAVY DUTY RAM handles open centerloads such as coils of steel—*Towmotor Corp, 1226 E 152nd St, Cleveland 10, Ohio*

MORE DATA? Circle 56 inside back cover



Valenite's VMU System of Milling Adds to Efficiency and Economy

VMU cutters differ from other throw-away insert milling cutters in two ways: the carbide inserts are held in precision, hardened tool steel cartridges and mounted in a standard cutter body; cartridges of the same shank size are interchangeable and are obtainable in various rakes, leads, and insert styles. Interchangeability permits use of one common cutter body on various operations. It is possible for one body to be used in milling cast iron, steel, or aluminum, according to manufacturer.

Cutters use a standard shell mill arbor mount, Ingersoll style drive, or the optional National Standard drive, depending on cutter diameter. After mounting, cartridges are adjusted in the cutter to read within ± 0.002 on an indicator. After this is done the milling unit will operate within normal milling tolerances. VMU will hold this normal working tolerance when inserts are indexed or replaced without readjustment to cartridges.

Valenite Metals, Box 205, Royal Oak, Mich

MORE DATA? Circle 57, inside back cover

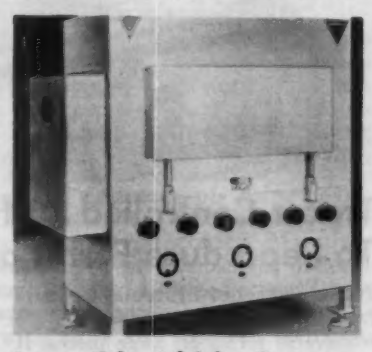
Adhesive Adaptable to Metal Bonds And Sandwich Structures

Metalbond 406, an unsupported, calendered tape currently supplied in rolls 18 in. wide, can be cut with ease and trimmed to the shape of the areas to be bonded. At room temperature the adhesive is dry, pliable, and easy to handle.

Since the material cures without releasing any solvents or condensation products, there is no need to provide for escape of volatiles from the bonded area. This advantage, plus its high wetting and filleting properties just before it cures, makes it particularly useful for bonding sandwich skins to core materials such as conventional honeycomb, or Multiwave. The inherent toughness of the cured adhesive also makes it an excellent metal-to-metal bonding agent. In metal-to-metal bonds room temperature shear strengths are in the order of 5000 to 6000 psi. In sandwich constructions, using aluminum ¼-in. cell size core material, and aluminum skin 0.020-in. thick, the room temperature climbing drum peel strength of the core-to-skin bond is 150 lb per 3-in. width.

Narmco Resins & Coatings Co, 600 Victoria St, Costa Mesa, Calif

MORE DATA? Circle 58, inside back cover



Rotary Tube Calcining Furnace Designed for Continuous-Flow Work

High-temperature electric furnace is designed especially for continuous-flow calcining or sintering of ceramic and metal powders. Model RT-472

incorporates an impervious Mullite tube that is readily adjustable in rate of rotational speed by means of a ring and pinion gear mechanism with a variable speed motor and drive. Rear legs of the unit are pivoted at the bottom, with the front legs manually adjustable to permit a furnace tilt or slight pitch from 0 to 5 in. This controls and insures smooth, continuous flow of fine particle size powder-like materials through the tube from entrance to exit end.

Total hot zone length of the 4⅛-in.-ID x 72-in.-long tube is 36 in. and variable rate of rotation is 0 to 6 rpm. Operating temperatures up to 2500 F and somewhat higher areas are obtained. Unit is capable of a continuous flow work load of 5 to 20 lb per hr. Over-all size of the basic furnace is 30 in. wide x 54 deep x 64 high. Though available for various power requirements, the standard is 30 kw, 220/60/1.

Pereny Equipment Co, Columbus, Ohio

MORE DATA? Circle 59, inside back cover

Electronic Micrometer Equipped With Opposed Heads

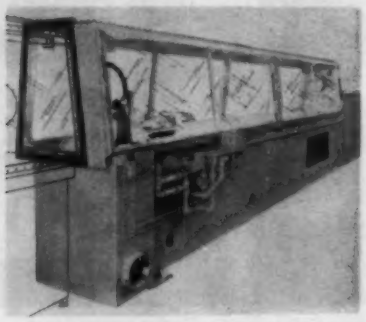
Model VDR electronic micrometer is said to be the first opposed head measuring device to permit pressureless measurement from two sides of a fragile or compressible part.

Opposing micrometer tips may be zeroed against each other at a selected reference position or at the anvil surface. Electronic controls bring upper tip down to touch the top of the part and the lower tip up through a hole in the lower anvil to touch the bottom of the part.

Measurements to 20 millionths of an inch are automatically displayed on direct-reading counters.

J W Dice Co, Englewood, NJ

MORE DATA? Circle 61, inside back cover



Drawbenches Used to Fabricate Nuclear Reactor Fuel Elements

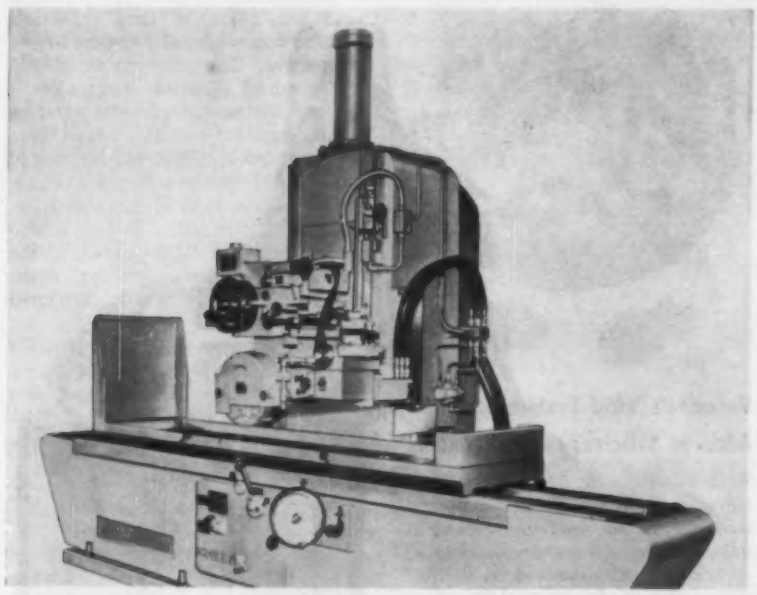
Two identical drawbenches are designed to fabricate fuel elements for Plutonium Recycling Test Reactor at Richland, Washington. The benches exert a 25,000-lb pull over a 12-ft length of stroke with variable drawing speeds from 0 to 20 fpm. Acceleration is smooth throughout the stroke.

By remote control, the infinitely adjustable draw dies can be placed in position for drawing configurations other than rounds and the rolls can be adjusted for size and dimensional accuracy and removed from drawing position when conventional rounds are processed. One piece of basic equipment can be used to draw squares, rectangles, hexagons and rounds.

The entire drawbench is hooded to contain atmosphere exposed to plutonium or plutonium-contaminated surfaces.

Fenn Mfg Co, Fenn Rd, Newington, Conn

MORE DATA? Circle 62, inside back cover



Tracer-Controlled Surface Grinder Designed To Reproduce Forms on Large Workpieces

Tracer-controlled hydraulic-feed surface grinder is designed to reproduce transverse forms on large pieces. It can handle forms too large to grind with a single wheel or materials requiring diamond wheels where the cost of formed wheels is prohibitive.

The grinder is equipped with automatic cross feed and automatic down feed. Automatic cross feed can be preset to feed from 0.008 to 0.040 at each table reversal and has a total travel up to the full width of the work table. Automatic down feed removes from 0.0025 to 0.060 in. per pass and is equipped with an automatic stop.

Gallmeyer and Livingston Co, 400 Straight Ave, SW, Grand Rapids, Mich

MORE DATA? Circle 60, inside back cover

Houghton Compounds Developed For Specific Cleaning Applications

New Cerfa-Kleen series is limited to four products tailored to the exact requirements of four basic industrial metal cleaning processes. They are: Cerfa-Kleen HPW (hot power washer)—heavy-duty cleaning compound with no free caustic, reported as non-foaming, non-caking (rust preventive added); CPW (cold power washer)—formulation of mild, fast-dissolving alkalies usable at

Hall of Progress founder Leighton A. Wilkie flanked by brothers James and Robert before "The Dawn of This Age" exhibit.

Hall of Progress Dramatizes Man's Inventiveness

In the origins of history man learned to extend the power and usefulness of his hands with tools. Since then, every new or improved tool has helped raise his economic and cultural welfare.

DoALL's Hall of Progress in Des Plaines, Ill. contains a unique industrial museum where this dramatic story unfolds in a 30-foot sunburst exhibit, "The Dawn of This Age." Here the evolution of technology radiates across nearly 200 years—from the original Watt steam engine of 1776 to the latest basic machine tool, the metal-cutting band saw.

Needed—a philosophy of tools

"Tools have been, and always will be, man's way of changing natural resources into products he needs and desires," says L. A. Wilkie, DoALL board chairman. "Thus, our mission is to sell the philosophy of the tool as well as the tool itself."

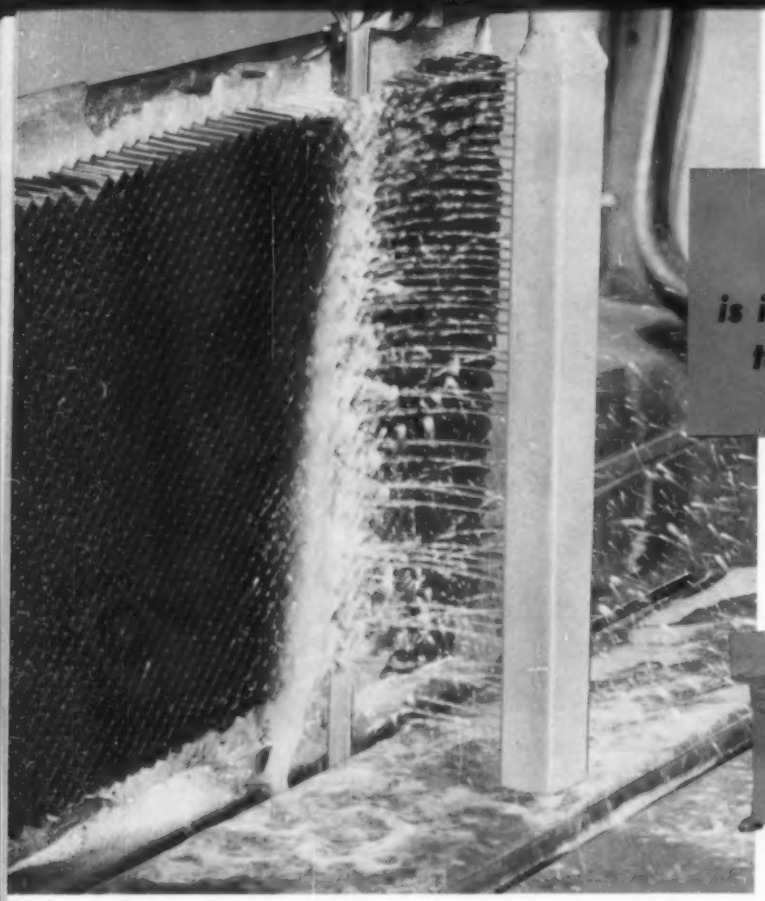
Demonstration Center speeds research

At its Des Plaines headquarters DoALL also maintains a Demonstration-Test Center where researchers and creative engineers work constantly to help industry penetrate new frontiers of productivity by machining with modern band sawing methods to remove metal in chunks instead of chips.

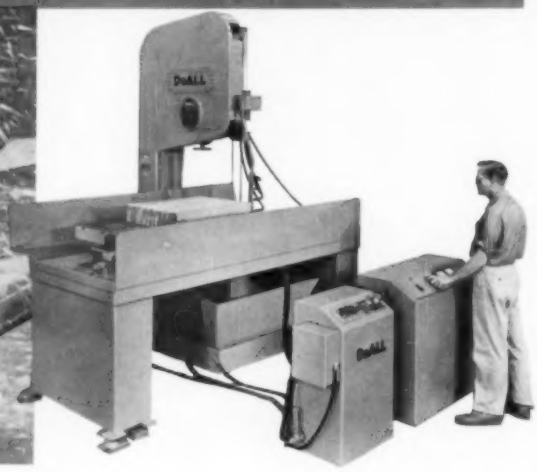
The innovations and new concepts being developed by DoALL constitute a valuable source of information for greater productivity. Manufacturing executives may avail themselves of local assistance through 38 DoALL Sales-Service Stores where trained specialists provide prompt, personalized service with store and research facilities.

Productivity builds America... **DoALL** *builds productivity*

For help in cutting, machining, finishing and measuring operations, call your local DoALL Sales-Service Store or write: The DoALL Company, Des Plaines, Illinois.



Productivity
is increased only with better tools . . . better methods



Slab of stainless steel honeycomb foil is sliced to 9/16 in. thickness at rate of 50 sq. in./min.

Sparks Replace Teeth to Slice Honeycomb Metal

"Honeycomb" of stainless steel or aluminum foil forms the core for tremendously strong, lightweight aircraft sections—but it presents a very touchy machining problem. This foil is so frail and delicate that it is easily crushed in the hand. Yet it must be machine-finished to close tolerance, without burr, for bonding to metal skins.

To solve this vexing problem DoALL engineers developed an entirely new process—"Electro Band Machining"—an extension of the DoALL band sawing principle. A standard DoALL machine is modified for this purpose.

Cuts by means of a water-quenched arc

Replacing the usual saw band is a special band electrically energized to sustain an arc. As the swift-moving knife-edge band meets the metal, an electric arc is produced that melts the thin sections of foil and is immediately quenched by water. Producing a finish equivalent to that of grinding, the new DoALL process replaces old methods at a substantial saving in time and material. And this new step in productivity promises further economies in cutting other thin, difficult-to-support materials used to make heat exchangers, radiator cores and various missile parts.

Innovations lead the way

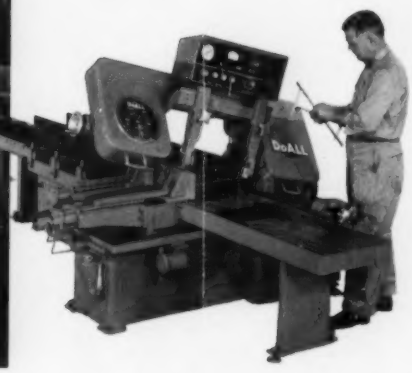
From the original DoALL metal-cutting band saw, the history of this company has been one of innovation. The many new applications of band sawing offer manufacturers hundreds of new opportunities to increase their productivity. Tremendously increased cutting rates . . . fixturing . . . and automation of band sawing equipment provide savings that were impossible only a few years ago.

At the DoALL Demonstration-Test Center in the new Hall of Progress at Des Plaines, Ill., research engineers welcome your problems in metal cutting, finishing and dimensional control.

Productivity builds America . . . **DoALL** *builds productivity*

Call your local DoALL store or write:
The DoALL Company, Des Plaines, Ill.

Productivity
is the product of better tools



Power saw and saw band of high-speed steel are teamed for high productivity on automatic cut-off work.

New Power Saw Makes Other Methods Obsolete

Just as tools were the first step in man's mastery of his environment, so each new and better tool plays its part in converting raw materials into the products that serve human wants.

A striking example, and a problem still critical in thousands of metalworking shops, is that of reducing stock to workable sizes in the quickest, most accurate and economical way. For many years such cut-off operations have been the tedious task of the power hacksaw, which operates on the slow reciprocating principle of the handsaw.

Enter: the DoALL power saw

Today DoALL power saws using Demon® h.s.s. saw bands make other methods obsolete. This machining "team" sets new standards in faster cutting rates, greater accuracy and new production economies for both straight and angular cut-off work.

Efficiency of DoALL power sawing stems from the continuous cutting action of thousands of sharp, hardened teeth. Even the largest billets and barstock can be "slugged"—cut automatically into machinable sections—in an uninterrupted cutting operation. The narrow saw band kerf saves material, further reducing the cost.

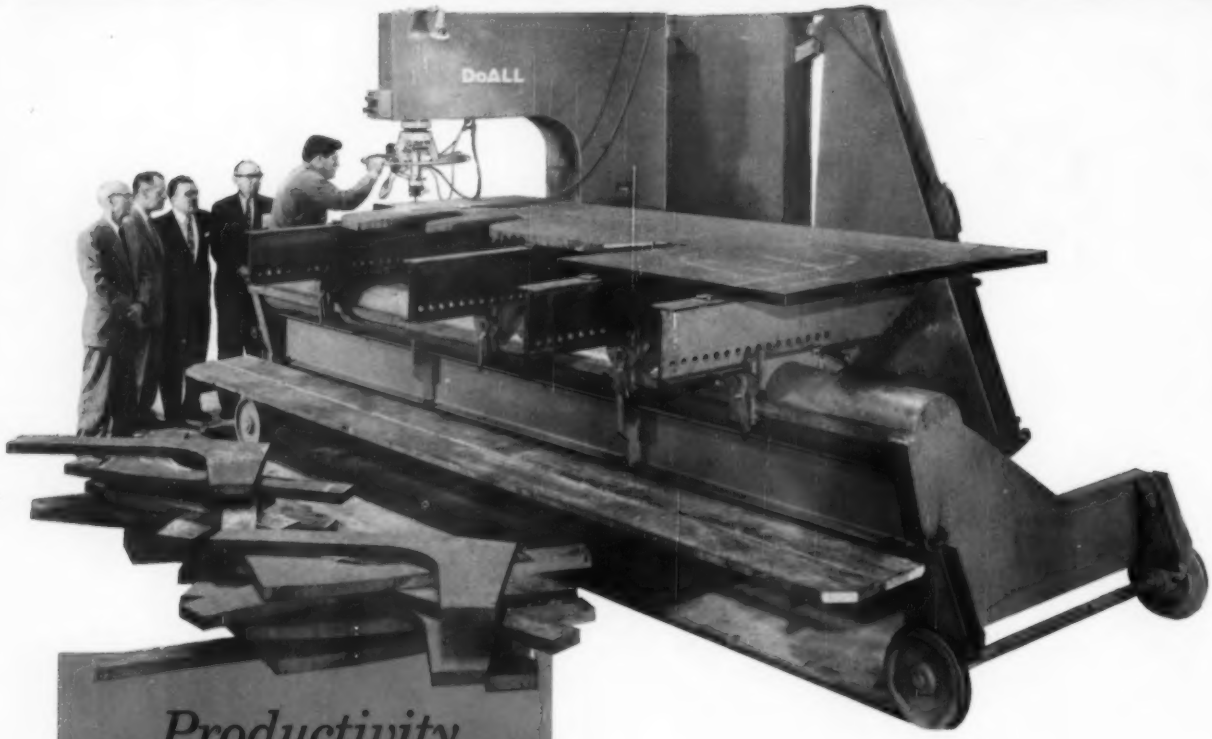
Time and again it has been shown that one DoALL automatic power saw can do the work of *three* old-fashioned power hacksaws. The result is a new era of productivity—the kind that is building a brighter future for this country . . . and for much of the Free World as well.

— a revolutionary idea

Removing unwanted metal in large pieces rapidly by band sawing instead of slowly chipping it away is revolutionizing production. Out-of-date machine tools are giving way to new, high-speed DoALL machining methods. DoALL specialists, operating from a nation-wide network of 38 DoALL stores, are productivity consultants to American industry.

Productivity builds America . . . **DoALL** *builds productivity*

For help in metal cutting, grinding and precision measurements call your local DoALL Sales-Service Store or write: The DoALL Company, Des Plaines, Ill.



Productivity
is the basis of economic leadership

The cutting edge of the Pan-Arm Contour Saw moves in any direction over a work area of 99 sq. ft.

Huge Parts Machined without Moving the Work

One of the new dramatic achievements in DoALL band machining is the Pan-Arm® Contour Saw. The operator guides the saw band *through* intricate contours without moving the massive steel plates. This is another DoALL innovation that advances the productivity of band machining.

Closed circuit TV guides the operator

The Pan-Arm machining of irregular shapes in 10,000-lb. blocks solves problems impossible to overcome by any other method. The operator sits at a remote control panel and steers the saw band through steel slabs by following the layout line on a closed circuit TV screen. Because the Pan-Arm Saw makes contour cuts in heavy steel plates, it can eliminate the need for large castings or forgings. The Pan-Arm Saw extends the range of band machining to huge parts and therefore offers great possibilities for savings in both time and material.

Many new applications of band machining offer hundreds of ways for manufacturing executives to increase their productivity and cut unit costs. The advantages from simple fixturing and automation of band sawing equipment greatly increase production by utilizing cutting rates that average 650 per cent faster than a few years ago.

Behind the 200 sawing specialists operating out of 38 local DoALL Sales-Service Stores are the research facilities of the new Demonstration-Test Center in Des Plaines, Ill. Here free assistance is available on a wide variety of problems in the field of band machining, cutting tools, surface grinding and dimensional control.

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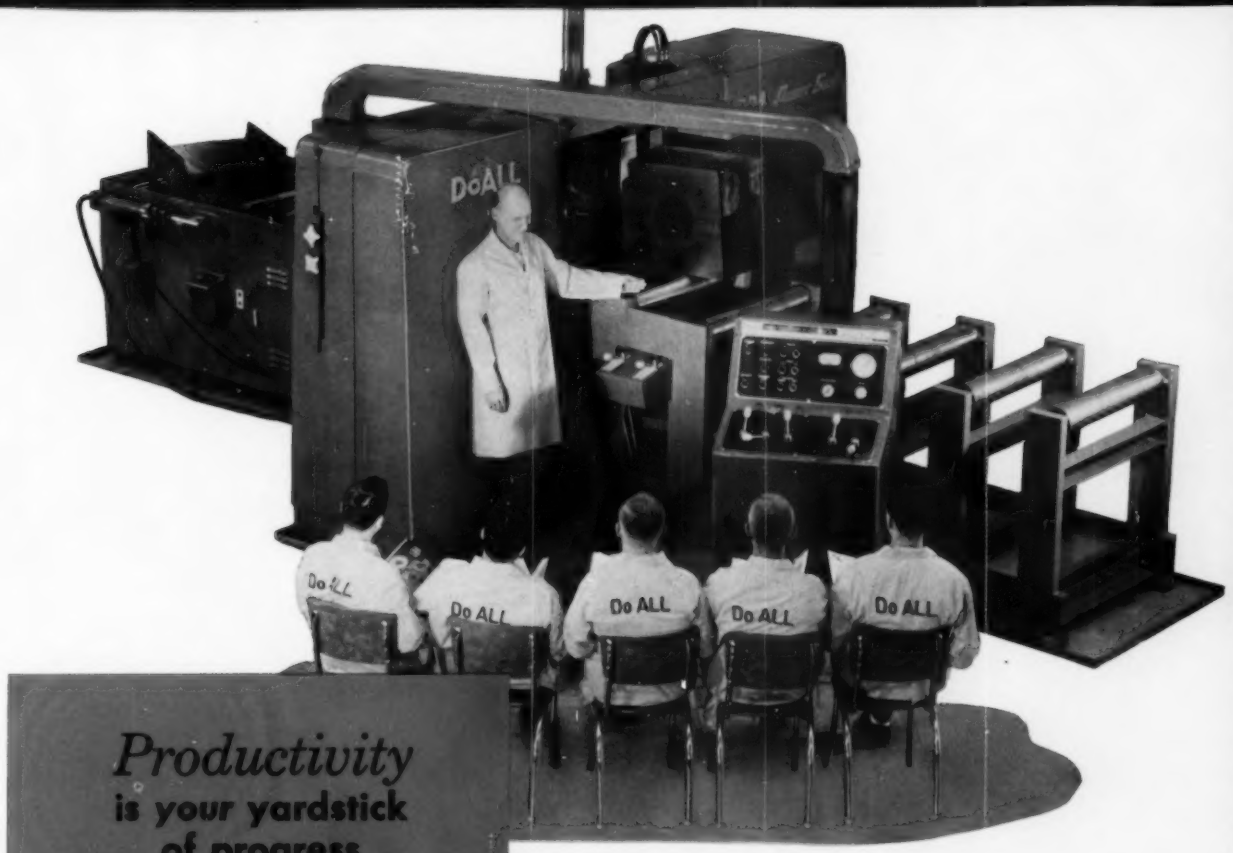

Productivity
is your yardstick of progress

Model C-24 automatic DoALL power saw applies band machining economy to huge cut-off operations.

Keeping Pace with Fast-Moving Production Ideas

These DoALL sales-service engineers are getting another briefing on new machining developments that are changing America's industrial scene—for only by using more productive tools can industry keep pace with competition here and abroad.

Demonstrating to manufacturers the value of these machining advances is this corps of more than 200 imaginative DoALL specialists, trained to look for new solutions to machining problems. Their expert help, backed by the research facilities at DoALL's Demonstration-Test Center in Des Plaines, Ill. is available for the asking.

An impressive "progress report"

Some idea of the amazing growth of DoALL band sawing can be gained from a review of progress made during the last few years. Today, workpieces weighing tons are machined on DoALL machines easily—yet, not long ago, the maximum weight was 100 lb. Internal and external cuts are being made from four to eight times faster than on previous machines and with greater accuracy.

From the first DoALL saw band capable of cutting 300 sq. in. of metal, band life has been increased so that new DoALL saw bands will cut up to 50,000 sq. in. of metal. DoALL offers the best band for cutting any kind of material for all machining jobs.

Productivity builds America... **DoALL** *builds productivity*

For help in material cutting, finishing and precision measurement, call your local DoALL Sales-Service Store or write: The DoALL Company, Des Plaines, Ill.

DoALL precision surface grinders finish grind any surface to the finest tolerance, no matter how dense the material.

Now—Direct Dialing to .0001-In. Grinding Accuracy

Today's man-made marvels—rockets, jet engines, electronic equipment—have one thing in common: a need for extreme accuracy at every stage of manufacture. These vital accuracies now can be attained in less time and with far less chance for error—thanks to DoALL precision surface grinders.

Fingertip control replaces hammer

In recent "grind and measure" methods, grinding accuracy depended on the skill of the operator. Tedious work and tapping the column with a soft-faced hammer might give finish cuts to a thousandth of an inch. When DoALL introduced its first precision surface grinder, most grinders were manually cranked back and forth and the cross-feed handwheel was jogged after each stroke.

DoALL employed automatic hydraulic controls that relieved the operator of this tedious work. New machine design and engineering principles controlled work heat and wheel wear—and the operator could rely on the grinder's handwheel calibrations. "Cool Grind"—a patented technique of applying coolant through the wheel was introduced. Now he simply "dials" for precise dimensional control to get "tenth" accuracy—a feat impossible on many surface grinders even today.

Grinders meet every application

These fundamental features now form the basis for a complete line of DoALL surface grinders whose applications range from semi-automatic tool room operation to fully automatic slot grinding, from heavy crush form grinding to precision slicing of brittle semiconductor materials. Engineered for weight distribution, balance, heat dissipation and control function, every DoALL grinder is a superb example of a craftsman's art. DoALL's Demonstration-Test Center increases productivity by helping to solve problems in metal cutting, grinding and dimensional control.

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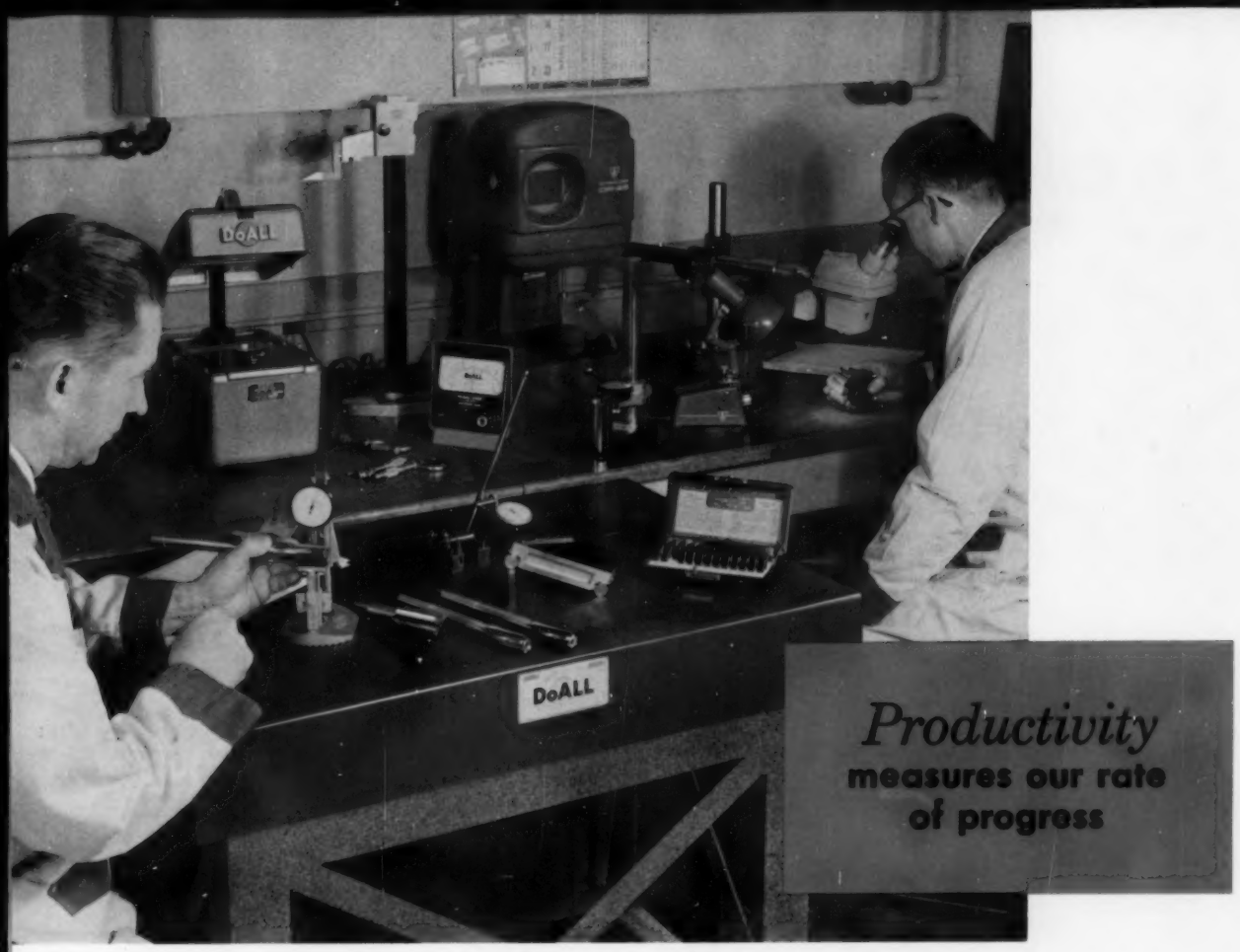

Integrated precision measuring instruments assure more productive quality control.

Meeting Space Age Needs for Ultra-Precision

When James Watt divided the inch into 256 visible parts in 1772, and Henry Maudslay followed in 1805 with divisions as fine as 1/1000 of an inch, the world marveled. Yet today's demands are for measurements to one ten-millionth of an inch.

Progress in measurement standards

Credit the Egyptians for both the concept of using a standard unit of measurement and making it out of black granite, nature's most stable material. From their measuring standard, the Royal Master Cubit Stick, man has evolved today's gage blocks having millionth accuracy. With this precise reference standard inspectors can check all types of everyday measuring instruments to assure accurate dimensional control. As a result, the production of mating parts by different manufacturers is greatly simplified.

The latest improvement in the field of precision measurement is DoALL's new line of stainless steel gage blocks. These gage blocks have longer life and provide greater stability and resistance to corrosion. Another DoALL improvement is a transistorized amplifier sensitive to length differences of only one ten-millionth of an inch.

Black granite is "rediscovered"

Basic to precise dimensional control is an extremely flat reference plane. The ideal material for this type of surface is black granite, the material which the ancient Egyptians used in their Royal Master Cubit Sticks. Today DoALL uses black granite in its precision surface plates to assure their being dimensionally stable and extremely resistant to accuracy-destroying wear and abuse.

Manufacturing executives and inspection personnel all over the world can continue to look to DoALL's metrology research center in Des Plaines, Ill. for more precise and productive measuring instruments and the latest in technical know-how.

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Productivity
provides service wanted — immediately

Typical DoALL Sales-Service Store has demonstration showroom, complete stocks of tools and finest equipment for custom-welded saw band service.

New Kind of Corner Store Serving Industry

One of the unique institutions on the American industrial scene is the local DoALL Sales-Service Store. It is part of a nation-wide network providing a broad, personalized service to manufacturers. Each of the 38 DoALL stores serves its area as headquarters for band machining, precision grinding, measuring equipment and all types of cutting tools.

With their complete line of cutting tools, these DoALL stores act as "tool cribs" for many manufacturers. This eliminates their need for storage space and investment to carry large inventories of their own. In addition, each store provides complete saw blade welding, sharpening and reconditioning service.

Each of the 38 stores is linked to a central warehouse in Des Plaines, Ill., by one or more teletypewriters. Orders for special items not in local stock are transmitted instantly—and any of more than 1,500 types of tools can be shipped at once from this central $3,000,000 stock. This assures each customer a safe, sure way to get the best tools and service wanted—immediately.

The combination of lightning-fast delivery, rock-bottom distribution costs and "in-plant" demonstrations has proved its efficiency—as many DoALL customers will testify. Hy-spiral taps, vanadium end mills and radial design center drills are just a few DoALL innovations to increase the productivity of tools.

Productivity builds America... **DoALL** *builds productivity*

Call your local DoALL Sales-Service Store or write: The DoALL Company, Des Plaines, Ill.

room temperature, non-foaming, caking, dusting, no free caustic, (rust preventive added); HST (hot soak tank)—high detergency compound for fast immersion cleaning in hard water, non caking, dusting, no free caustic; CST (cold soak tank)—concentrated liquid to replace toxic or flammable solvents, no free caustic. Also usable for wipe-off, tumbling, and other mechanical cleaning operations.

E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Penna

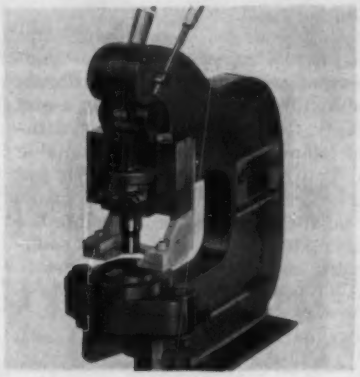
MORE DATA? Circle 63, inside back cover

Single-Cylinder, Single-Acting Hydraulic Rams Offered by OTC

New line is available in nine sizes from 1-11/16 in. long with ⅝-in. stroke to a 20¼-in.-long ram with 13½-in. stroke. Capacities are from 2 to 50 tons with max working pressures of 8650 and 10,000 psi.

Owatonna Tool Co, 383 Cedar St, Owatonna, Minn

MORE DATA? Circle 64, inside back cover



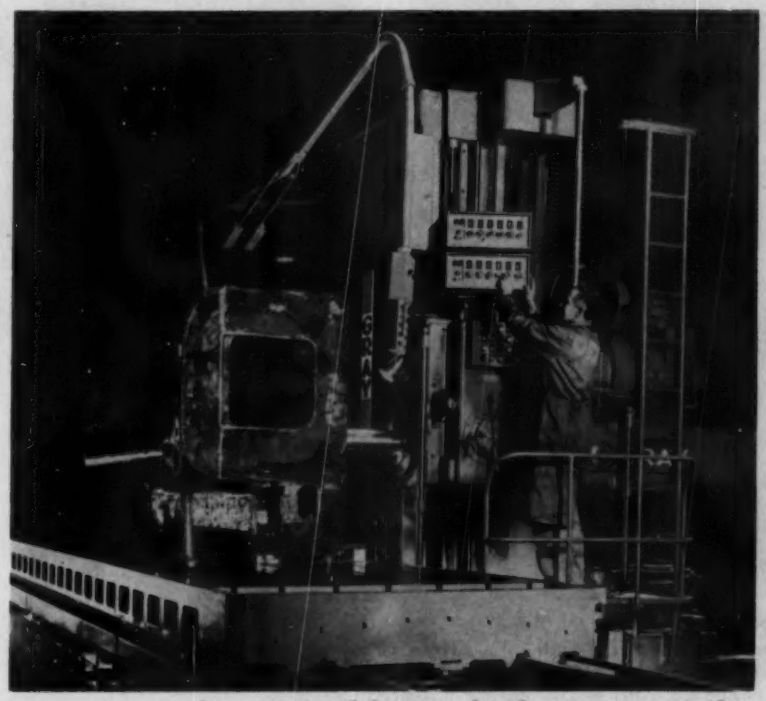
Hand Punch Will Punch ¼-in. Hole Through 3/16-in. Steel

No. 118 hand punch will punch a 2 in. hole through 14-gage mild steel or a ¼-in. hole through 3/16-in. mild steel. A power press type ram is used to provide this large capacity and an eccentric arm mechanism rolling on a roller bearing makes it easy to operate.

Ram adjustment totaling 3/16 in. is said to permit the use of small forming dies, hold close tolerances and extend punch and die life. The machine has a 7-in. throat depth and 4½-in. throat height. Price is $125 for the bench model and $160 for the floor model.

Whitney Metal Tool Co, 724 Forbes St, Rockford, Ill

MORE DATA? Circle 65, inside back cover



Gray Introduces Building Block Numerical Control System for Planers, Boring Mills

Modular printed-circuit numerical control system has been developed for planers and boring mills by G A Gray Co and Norden Data Systems Division of United Aircraft Corp.

One of the features of the system is that it offers progressive steps to full control by simply adding building block elements. Dialing of coordinates and tape-controlled preplanned programming can be added when needed and may be bought individually.

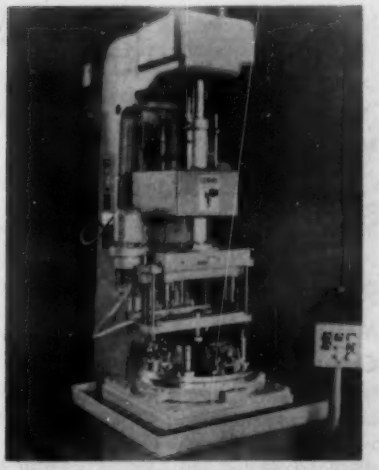
The control unit, called the Space Setter, is equipped with a readout gage which shows the exact location of a machine tool element at all times. A zero offset feature makes it possible to establish zero readout at any reference point on the workpiece. Hole-to-hole and surface-to-surface reading dimensions set on the centerline of the machine spindle agree exactly with engineering drawings.

Space Setter's display gage reads to three decimal points for each axis and registers overall accuracies to 0.001 in. The system is absolute, there being no accumulated error as is sometimes found with leadscrews. The system is unaffected by line voltage variations, is jam-free and has no thermal drift.

Capable of operating at traverse rates up to 360 ipm, it is available for Gray horizontal milling and boring machines and for planer type milling machines.

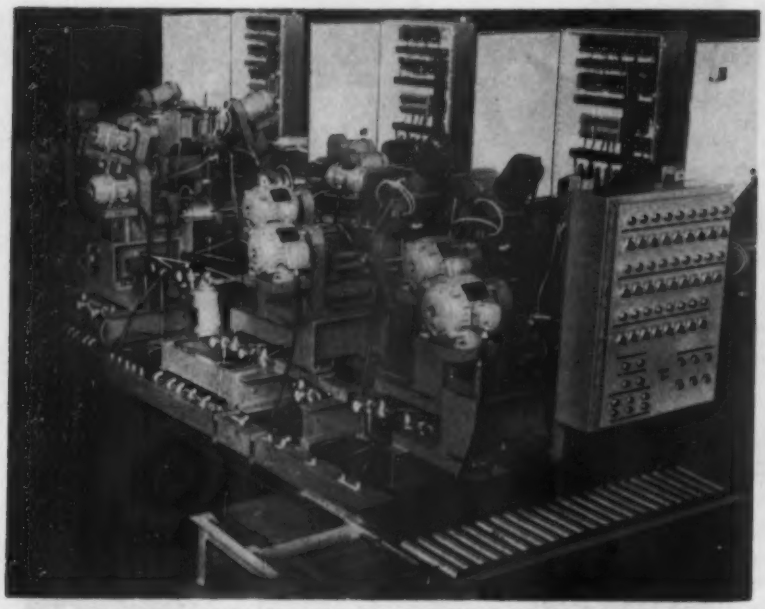
G A Gray Co, Dept A, Cincinnati 7, Ohio

MORE DATA? Circle 67, inside back cover



AUTOMATIC DRILLING AND TAPPING MACHINE, equipped with a four-station index table, drills, chamfers and taps bleeder holes in wheel cylinder bodies. The spindles are arranged in three groups of two each—*Cleereman Machine Tool Corp, Green Bay, Wis*

MORE DATA? Circle 66, inside back cover



IN-LINE TRANSFER MACHINE drills, taps, counterbores, spotfaces, reams and probes 54 different carburetor bodies at a rate of 200 parts per hour. It is said to cost 25% less than comparable machines—*Pioneer Tool and Engineering Co, 7401 W Lawrence Ave, Chicago 31, Ill*

MORE DATA? Circle 68, inside back cover

Transducer Provides Direct, Precise Automatic Control

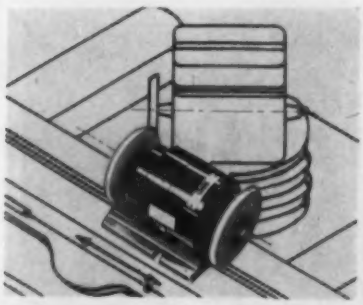
Regohm transducer, a compact variable resistance device responsive to 0.0001 in. of mechanical movement, can directly control up to ¼-kw of power. It can be used for automatic control without amplifiers for machining, materials handling, heat-treating and forming.

Mechanical connection to suit the controlled machine is made by shaping the linkage rod. Any change in position can move the unit's actuator to initiate control. It can be made responsive to a cam or lever, bending of a heat-sensitive bimetal, fluid pressure on bellows, tension developed by materials. Motion causes a change of resistance in the output circuit to regulate power machinery.

Estimated life expectancy is 50,000 hours with no lubrication or adjustment necessary.

Electric Regulator Corp, Pearl St, Norwalk, Conn

MORE DATA? Circle 69, inside back cover



Motorized Diamond Wheel Dresser Cuts Replacement Costs

Self-contained unit for carbide tool and die production and maintenance is said to be capable of dressing diamond wheels with absolute minimum of removal and loss of diamond surface. Motor-driven dressing wheels run opposite to or at an angle to the rotation of the diamond wheel to obtain fast, efficient cleaning and dressing. Dressing wheels operate at 3450 rpm—friction driving pressure and hogging are said to be eliminated. Direction of rotation is controlled by simply reversing position of the dresser on machine table.

Dresser is mounted on a slotted base which can be held by clamp or magnet to the bed of surface or cutter grinders and accurately fed with feed control of grinder table. Double-end 115-v 60-c 1-amp constant speed fan cooled motor is equipped with two dressing wheels for convenient location on grinder. Price is $39.50.

Niagara Cutter Division, Bollier-Damerell, 330 Niagara St, North Tonawanda, NY

MORE DATA? Circle 70, inside back cover

Lubri-Cut Machine Tool Lubricant Available in Improved Formula

Cutting and lubricating compound can now be used effectively with any material such as hard or soft ferrous or non-ferrous metals, stainless, titanium, most alloys, plastics, and even glass. Originally developed for use with either high or low speed machine tools, Lubri-Cut is said to be not only an efficient cutting agent, but also an effective coolant in such operations as drilling, tapping, and reaming. Properties include high thermal conductivity, fire resistance, non-oxidizing, anti-welding, and ability to stick to drill flutes without spin-off. Product is available in semi-paste tube form which can be squeezed directly on the work area; sticks, which are applied to the cutting tool; or in bulk cans of semi-paste, usually applied with brush.

US Chemical Milling Corp, 1700 Rosecrans Ave, Manhattan Beach, Calif

MORE DATA? Circle 71, inside back cover

Automatic Parts Feeder Handles Heavy Steel Slugs

Model 300 variable-speed parts feeder can be preset to any desired feed rate with automatic bank controls maintaining continuous flow of

Lindner LB14 Jig Borer at Philips Electronics, Inc., Mount Vernon, N. Y., has 32" x 16" table. Also available in larger model, LB15A with Autopositioner®—Table 44" x 24".

Precision Production—Boring 20 holes in the specimen plate cover of the Norelco Model 100KV Spectrograph. Done in one set-up. Time: 2 hours. *30% faster than previous methods!*

Precision Tooling—Boring holes in a drill jig for the Norelco Powder Camera. Opposite holes must be aligned within .0001".

How the Lindner Optical Measuring System brings greater precision to jig boring

at Philips Electronics, Inc.

A jig borer can be no more accurate than its measuring system. And in the Lindner the problem of maintaining *permanent* accuracy has been solved by the machine's unique *fully optical* measuring system.

No lead screws. No gage blocks. No bars or limit switches. The helically scribed, cylindrical measuring scales in every Lindner are touched by a light beam only. These scales are independent of the table movement mechanism and *immovable* in axial direction. Thus, the whole system is permanently protected against any mechanical wear whatsoever. Lifetime accuracy!

Visual fatigue and errors in settings are minimized by a photo-electric centering device. It makes possible initial and repeat settings guaranteed accurate within .00015" over the full length of travel and readings in .00005".

There's no eye strain or bending. A helical line from the measuring scale is projected onto a 2½" wide screen which the operator reads from a standing position. No eyepiece required.

That's why Philips Electronics—like so many other precision producers—relies on the Lindner for tooling, production and inspection of its Norelco atom measuring equipment and other precision research tools.

The Lindner optical measuring system is changing ideas about jig boring all over the country. We've packed all the facts into a meaty 25-minute movie film. Send for it today without obligation. Or write for literature.

KO CO. INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

36 Exchange Place, Jersey City 2, New Jersey

CIRCLE 258 READER SERVICE CARD

round steel slugs 3½ in. dia by 5 in. long. Feeder shuts off when feed track is full and resumes operation on demand.

Features include 25-cu-ft hopper, 12-in. wide belt, self-emptying bottom, adjustable elevating angle of the conveyor. Parts orienting devices can be applied on the elevating cleats, tooling plate or delivery track.

Feedall, Inc, 38399 Pelton Rd, Willoughby, Ohio

MORE DATA? Circle 72, inside back cover

Bridgeport Offers Clad Tube Sheet Up to 42 in. Diameter

Clad tube sheet is now available in diameters up to 42 in. instead of the previous 36 in. Sheet can be supplied in thicknesses up to 4 in. with claddings varying from 1/64 to ½ in. Copper-base alloys, and steels, including stainless, are used to provide strong, corrosion-resistant clad tube sheets. Reliability of the metal bond is over 3000 psi.

Bridgeport Brass Co, Bridgeport, Conn

MORE DATA? Circle 73, inside back cover

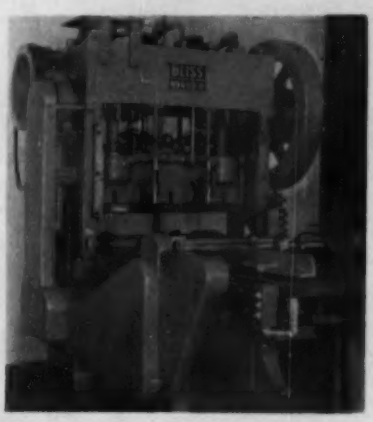
Ultrasonic Cleaner Priced Under $100

The Disontegrator System 40, priced at $99.95, is claimed to be the lowest priced ultrasonic cleaner available anywhere.

The cleaner has a half-gallon stainless steel tank and a 40-w, 90,000-cps generator. It is especially designed for small parts cleaning. The only control knob needed is a push-pull throttle to regulate the ultrasonic activity.

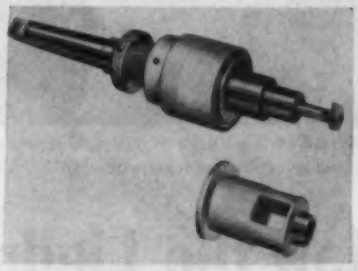
Ultrasonic Industries, 141 Albertson Ave, Albertson, LI, NY

MORE DATA? Circle 74, inside back cover



MULTIPLE DIE PRESS for large quantity cap production has operated speeds from 100 to 125 spm. Entire lithographed sheet of tin plate or aluminum can be fed to the multiple dies, producing 8, 10, or even more caps at each stroke—*E W Bliss Co, 1375 Raff Rd, SW, Canton 10, Ohio*

MORE DATA? Circle 76, inside back cover



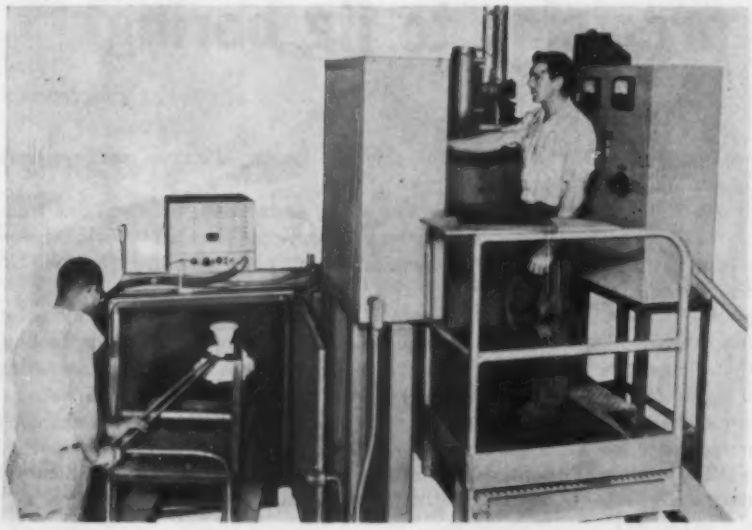
Automatic Recessing Tool Features Snap-On Work Pilot Adaptor

Interchangeable adaptor permits piloting of the tool in the work as well as in a fixture bushing. Adaptor is normally used on turret lathes, automatic screw machines, and other equipment where the work is rotating. The tool may pilot in a fixture bushing on machines where the spindle is turning. Solid, single-bar construction minimizes tool chatter.

Three basic types of standard tools are made for work diameters from 0.375 to 2.250 in. and depth of cut up to 0.281 in. Cutter heads are available to perform a wide variety of intricate operations such as relieving, grooving, forming, back facing, chamfering, counterboring, and necking. Recessing cutters are made to perform these operations singly or in combinations, eliminating complex tooling and permitting completion of multiple operations in a single pass.

Madison Industries Inc, PO Box 1137, Providence, RI

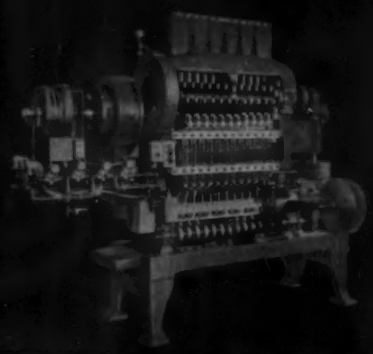
MORE DATA? Circle 77, inside back cover



INDUCTION-HEATED FURNACE permits semi-continuous vacuum melting and casting. The 50-100-ton unit has the mold chamber connected to the melting chamber by a lock which allows mold transfer without breaking vacuum. A 17-50-ton model is also available—*F J Stokes Corp, 5500 Tabor Rd, Philadelphia 20, Pa*

MORE DATA? Circle 75, inside back cover

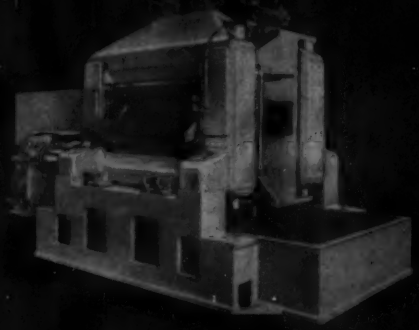
COLD HEADING
MACHINERY

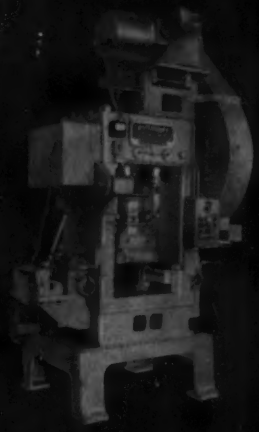


EYELET, SLITTER
& WIRE
MACHINERY

WATERBURY
FARREL
MACHINERY BUILDERS

ROLLING MILL
MACHINERY





POWER
PRESSES

THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC
Waterbury, Connecticut, U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

Multiple-Hole Punch and Die Set Is Adjustable, Reusable

Adjustable punch and die set enables the user to punch holes of various sizes and shapes in one operation and reuse the tooling. Pegboard die sets permit punch and die holders to be arranged into a variety of hole patterns with the use of a templet.

Especially suited for short run production, the Di-Acro tooling can punch material as thick as 16-gage mild steel and ⅛-in. aluminum to tolerances of ±0.005 in.

The sets are available in two styles: back post type requires minimum press shut height of 6¼ in.; center post type requires minimum press shut height of 6¾ in. They can be setup either inside or outside the press.

O'Neil-Irwin Mfg Co, 512 Eighth Ave, Lake City, Minn

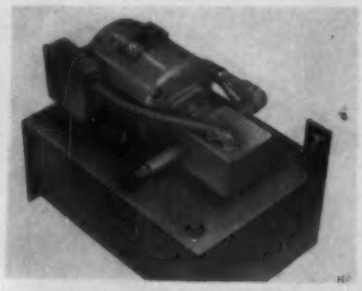
MORE DATA? Circle 78, inside back cover

Stainless Steel Powder Produces Corrosion-Resistant Components

Parts fabricated from this stainless powder mix reportedly have about the same good corrosion resistance as cast and wrought stainless material and can be produced at a cost saving. Powder, which is not prealloyed, can be used to produce structural shapes which reportedly exceed 95% of theoretical density. And, since powder metallurgy makes possible the production of precision shapes without expensive machining, users of parts fabricated from this powder can realize significant cost economies. Relatively low compacting pressures are required, minimizing die wear. Finished shapes are said to exhibit outstanding strength, ductility, and impact properties.

Union Carbide Metals Co, 30 E 42nd St, New York, NY

MORE DATA? Circle 79, inside back cover

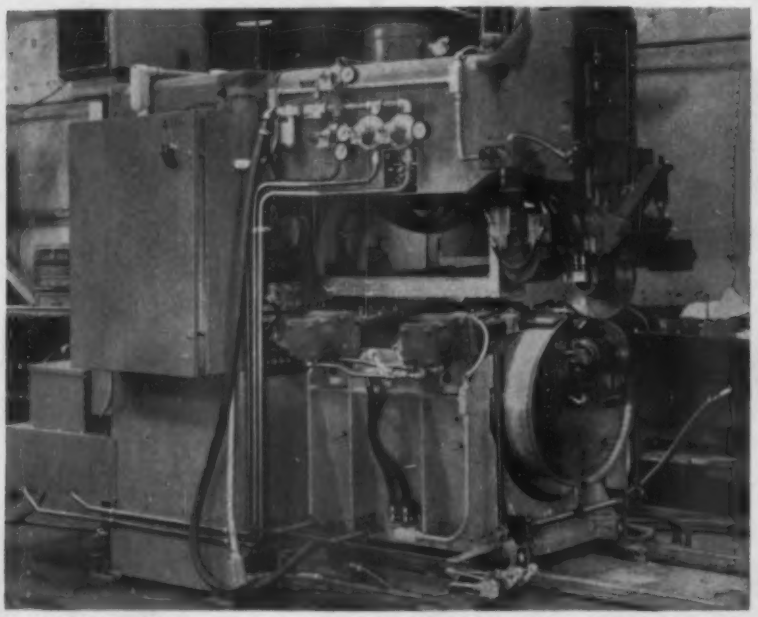


New Hydraulic Package Powers Range of Industrial Equipment

Auto-Power package provides 1½-gpm output at 2000 psi. This power is readily adaptable for press duty, machine feeds, lift tables, as pushers and punchers, or for any intermittent or job duty applications. Precision gear pump is directly coupled to a special-design electric motor capable of producing up to 3-hp output at its duty rating. Also built-in are adjustable relief valves, ball check valves, and removable screen suction filters mounted on a 4½-gal oil reservoir.

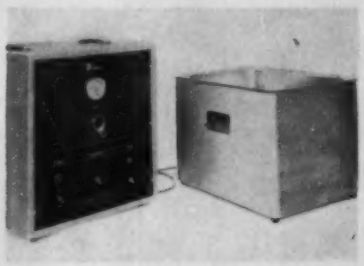
Autoquip Corp, 1140 S Washtenaw, Chicago 12, Ill

MORE DATA? Circle 80, inside back cover



DRUM WELDER designed for low-cost low-production operation uses a flexible band clamp housed on a traveling fixture to achieve narrow lap and eliminate end splitting. Unit mash welds containers from 14 to 22½ in. dia up to 40 in. long. Run by a single operator, the machine can turn out 250 55-gal drums per hour—*National Electric Welding Machines Co, Bay City, Mich*

MORE DATA? Circle 81, inside back cover



Ultrasonic Cleaner Designed For Average Applications

Model 160 ultrasonic cleaner, designed for applications requiring average energy levels, has a 115-v ac single phase 60-c generator. It delivers an average power output of 500-w and peaks at 2000 w.

The unit has a 13-gal stainless steel tank with 30% of the bottom

NEW

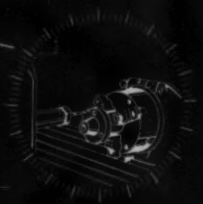
ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in

straddle milling



milling

inspection

jig drilling
with either micrometer or "Jo" block setting

Write for free catalog *"Erickson Master Spacer"* today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

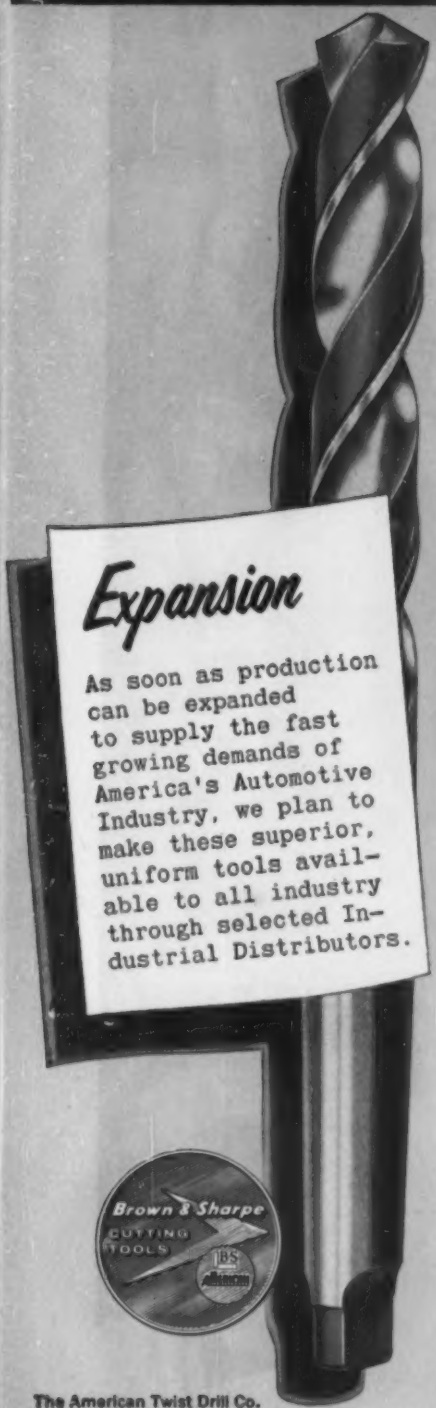
AA-3091

ERICKSON TOOL COMPANY

34559-3 Solon Road • Solon, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

AMERICAN


Expansion
As soon as production can be expanded to supply the fast growing demands of America's Automotive Industry, we plan to make these superior, uniform tools available to all industry through selected Industrial Distributors.
Brown & Sharpe
CUTTING TOOLS
IBS

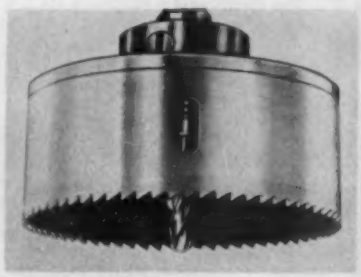
The American Twist Drill Co.
Detroit, Michigan
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island

AMERICAN

covered with crystals. Radiating surface is 96 sq in. Other features include one-tube oscillator, front panel switching which permits a choice of either of two transducers, forced-air cooling and three-wire ground protection. Price is $1375.

National Ultrasonic Corp, 111 Montgomery Ave, Irvington 11, NJ

MORE DATA? Circle 82, inside back cover

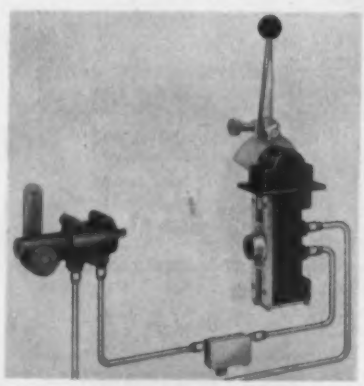


High-Speed Hole Saw Added to Clemson Line

Hole saw, tradenamed Moly, has high-speed cutting edges capable of cutting clean, round holes in materials from 9/16 to 6 in. in diameter. It is designed for use with both portable power tools or machine tools such as lathes, drillpresses, and radial drills. Saw cut's OD is slightly larger than the diameter of the body, permitting it to follow completely through its own hole and enabling cutting of two or more walls, partitions, or stacked material.

Clemson Bros Inc, Middletown, NY

MORE DATA? Circle 83, inside back cover



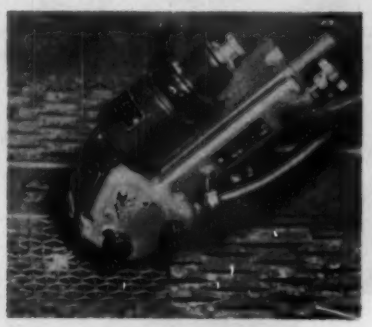
Remote Controls Incorporate New Vernier Adjustment

Hydronic remote control system is a manually operated, hydraulic linkage for accurately positioning, controlling, and duplicating movement at a distance. It is used for control of valves, clutches, brakes, throttle, transmissions, feed mechanisms, engines on test stands, and similar applications.

With the new vernier lock, the master unit lever is moved to the approximate location and locked in position. Vernier adjustment then permits precise lever travel of ± 5° for applications requiring very accurate positioning. Master units are also available with the lock only.

Hydronic Corp, 12685 Arnold, Detroit 39, Mich

MORE DATA? Circle 84, inside back cover



Arcair Torch Speeds Cutting Of Wire Cloth and Expanded Metal

Arcair Process torches will quickly cut wire cloth and expanded metals of any weight or alloy, leaving a clean, smooth cut that needs no deburring. Heat input to the metal is much lower than with flame cutting, so that structure of the metal remains unchanged. Materials can be cut with either manual or automatic Arcair torches at speeds of 48 ipm. Torches use a special electrode, welding current, and ordinary compressed air. Heat from the arc melts metal instantly and compressed air blows it out of the way.

Arcair Co, PO Box 431, Lancaster, Ohio

MORE DATA? Circle 85, inside back cover

"Fired! I thought slaves were sold."

Electronic parts courtesy Judson Mfg. Co., Inc., Cornwells Heights, Pa.

Mirror-bright without polishing, after switch to Sunicut

Boring on a multiple-spindle automatic produced the finish you see on these electronic parts. Sunicut 102-S Cutting Oil saved time and money by eliminating the polishing operation. The same automatic uses Sunicut 102-S to machine metals ranging from titanium to stainless 410.

Sunicut 102-S is one of a full line of cutting oils known throughout metalworking for maintaining long tool life, close tolerances, and fine finishes. There's a grade of Sunicut that can help you improve your product quality—and *that's* the best economy of all.

To choose the right Sunicut, ask the Sun man; that's part of his service to you. Or write to SUN OIL COMPANY, Dept. AM-3, *Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.*

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

NEWS!

FRAUENTHAL BREAKS ANOTHER ROCKET-AGE MACHINING BARRIER

NOW PRODUCING

Frauenthal 60" dia. Contour Finishing Machine with 15' length capacity designed and built for Walter Kidde & Co., Inc.

Now... machining and grinding nose cone and radome contours for aircraft and I. C. B. M. re-entry missiles . . . FRAUENTHAL Rocket-Age machines are here!

NOW PRODUCING

Frauenthal 36" Tracer Controlled Contour Grinder at work on a typical radome shape — also available in larger sizes.

NOW PRODUCING

Frauenthal Precision Contour Turning and Finishing Machine. Producing to accuracy of ± .0005 over entire 60" diameter contoured surface, with 4 RMS maximum finish on re-entry nose cone.

Developed for AVCO Research and Advanced Development Division on the Titan program.

Frauenthal is doing it *right now* — contour machining, grinding and micro-finishing metal, fiber glass and ceramic nose cones for America's Space-Age missiles.

These creatively designed machines can generate nozzle throat contours for rocket motors, lay up or wind resinoid bonded material on formed mandrels, contour turn and grind mandrels or other difficult-to-work shapes and materials.

Contact Frauenthal now for forward-thinking machine designs. You'll get advanced engineering that *anticipates* your current and future requirements. All to help you profitably BREAK THROUGH in your field of operations.

FRAUENTHAL

DIVISION

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U. S. A.

ELGIN
SOLID CARBIDE END MILLS

CUT PIECE PART COSTS
88%

Recently a manufacturer experienced increasing costs due to short tool life in milling magnesium sand castings to house a radar antenna. The milled part was roughly circular, approximately 3 feet long and the cut ranged from a few thousandths to as much as ⅛-inch. Its irregular shape made it impossible to eliminate vibration during milling.

The manufacturer had been using a ⅛-inch high speed steel end mill that cost $3.75 and averaged 15 pieces. Our distributor was sure an Elgin ⅛-inch Series 255 carbide end mill would more than pay its $19.20 cost. After the first Elgin solid carbide end mill produced 650 pieces, the manufacturer stopped counting! The tool cost per piece dropped from 25 cents to 3 cents. Elgin saved 88% of the piece part cost and consistently delivered a more accurate cut and a better finish . . . proof that you don't always need new machines to set new performance and economy records.

To learn how Elgin Solid Carbide rotary cutting tools can save you money on the production line call your Elgin distributor or write directly to:

SEND FOR THIS FREE, VALUABLE BOOKLET . . . describing and illustrating Elgin's complete line of solid carbide rotary cutting tools.

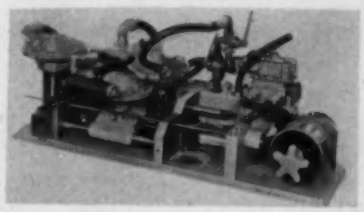
Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

Euclid Introduces New Line Of Electric Hoists

Series S features a one-piece gear housing and frame of heavy steel. Complete motor interchangeability permits use of any (Standard NEMA "D" flange mounted Series 180 or 210) motor with integral disk brake. Capacities range from 500 to 12,000 lb. They are offered with either lug or hook-on suspension and are available with plain trolley, hand-rack trolley, and motor-driven trolley.

Euclid Crane & Hoist Co, Chardon Rd, Cleveland 17, Ohio

MORE DATA? Circle 86, inside back cover



Wire Feed and Cutoff Unit Has Accuracy of 0.002 in.

New automatic self-contained Ses-Matic Wire Feed is adjustable to cut off wire in increments from 1 to 6 in. in length. Number of cutoffs per minute is adjusted from a speed control valve. Electrical controls provide stop and start. No adjustment is necessary when changing from one wire size to another within the range of the unit. A pay-off spool (with drag brake) for feeding and cutting fine wire is mounted directly on the feed unit base. This unit may also be used in conjunction with other types of coiled wire holding devices.

Ses-Matics for wire sizes up to 3/16 in. and stroke lengths from 1 to 24 in. are also available. Wire straighteners can be included with the units as optional equipment.

Special Engineering Service Inc, 7630 Wyoming, Dearborn, Mich

MORE DATA? Circle 87, inside back cover

TIME AFTER TIME AFTER TIME, THE SAME HIGH MACHINING SPEEDS AND FEEDS THAT STEP UP PRODUCTION—REDUCE COST . . . TIME AFTER TIME, THE SAME CLOSE TOLERANCE CONTROL, FINE FINISH, LONG TOOL LIFE . . . THE CONSISTENT AND DEPENDABLE QUALITY AND UNIFORMITY YOU NEED . . . YOU GET . . . WITH INLAND LEDLOY® LEADED STEELS. AND NO WONDER, FOR INLAND PIONEERED IN THE DEVELOPMENT OF LEADED STEELS . . . HAS LONGER, MORE CONTINUOUS EXPERIENCE THAN ANY OTHER PRODUCER IN THE WORLD . . . ASK YOUR STEEL SUPPLIER ABOUT
INLAND
LEDLOY®
Inland Steel Company
INLAND
30 West Monroe Street, Chicago 3, Illinois

Why Cadillac Gage MICROHONES* Drilled Bores in Hydraulic Units

Since 1940, Cadillac Gage Company has been known for the quality of its high precision gages. Cadillac's production "know-how" in obtaining close tolerances has in recent years led to diversification in precision products.

From Gages to Tank Turrets

For example, Cadillac has developed and are now producing, for a prime contractor, hydraulic systems that control gun elevation and traverse of gun turrets on military tanks. In these units, geometric tolerances in millionths of an inch and a controlled surface finish are mandatory for smooth, dependable performance. That is why sleeve bores in control valves and lock valve bodies are Microhoned.

Simple collet-chuck fixturing permits fast, easy accommodation of various workpiece sizes. A Micromatic-designed tool speeds tool changeover.

Efficient Stock-Removal and High Precision

Because Microhoning is both a stock-removal and a precision finishing process, Cadillac engineers specified only two machining operations for the sleeve bores: drilling and Microhoning. Sleeves (hardened to 63 R "C") are Microhoned to generate roundness and straightness within 20 millionths of an inch tolerance over the full length of the bore. Also, in removing from .008" to .010" of stock, Microhoning consistently produces a surface finish of 4 microinches rms.

MMT-PE

Higher Quality — Lower Scrap

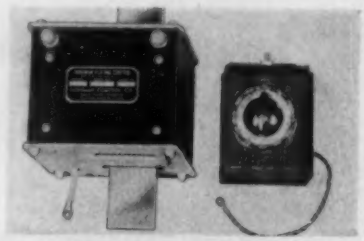
Every Microhoned bore is checked on a precision air gage . . . this 100% inspection insures highest quality control. Mating spools are selectively fitted to the Microhoned sleeve and clearance is held to between .00002" and .0001". Every sleeve and spool assembly must withstand a rigorous 3,000 psi leakage test. Scrap rate is practically nil.

With Micromatic equipment, Cadillac has substantially increased production; they control surface finish within closer limits; consistently generate specified geometric accuracy: and practically eliminate scrap. How Microhoning accomplishes these results is explained on facing page.

**Registered U.S. Pat. Off.*

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NEW SHOP EQUIPMENT



Automatic Plating Controls Have Controlled Current Cutoff Feature

New line of Hoffman DC-Matic Cut-Off plating controls for barrel platers using tank lines or automatics are reported capable of boosting production 20% through conservation of materials, electricity, and manhours. Operator pre-sets timer to exact minute for optimum time cycle. Green light signals current on. At end of time cycle current is automatically cut off; green light goes out and red light glows until timer is re-set, cutting current on for next cycle. Supervision maintains visual control of all processing at a glance. Controls, which require no maintenance, are guaranteed for a year against defects and failure while operating within limits of manufacturer's specifications.

Hoffman Control Co, 6804 Park Ave, Cleveland, Ohio

MORE DATA? Circle 88, inside back cover

Gage Speeds Diameter Readings Of Boring and Reaming Tools

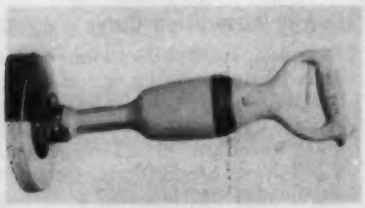
Adjust-O-Matic gage virtually eliminates need for a micrometer in adjusting tool diameters and permits adjustments to 0.0001 in approximately 10 seconds per tool. Instrument consists of a steel holder in which the tools are placed and a dial indicator graduated in 0.0005s. Operator has to mike only one tool to establish the desired size, place it in the holder, and adjust the indicator to zero reading. Each succeeding tool of the same size is placed in the holder and adjusted to the zero reading, assuring an accurate setting in a matter of seconds.

In adjusting tools of various di-

ameter sizes, operator uses a micrometer to read the current setting on each tool before placing it in the Adjust-O-Matic. He then expands the tool to desired size while reading the amount of adjustment in 0.0005s on the indicator face. Indicators graduated in 0.0001s are also available.

Muskegon Tool Industries Inc, Muskegon, Mich

MORE DATA? Circle 89, inside back cover



Wilson Adds 8-in. Model To Portable Pneumatic Grinders

New 905 Series consists of heavy-duty horizontal grinders, wire brushing machines, and horizontal buffers suitable for up to 8-in. wheels. Choice of four free speeds is offered, 6000, 4500, 4100, and 3100 rpm. Straight, lever, or grip handles may be specified.

Features include one-piece aluminum housing; one-piece hardened and ground spindle; four prelubricated and sealed spindle bearings; steel inserts in all housing threaded holes and bearing bores; and hardened, ground, and honed cylinder.

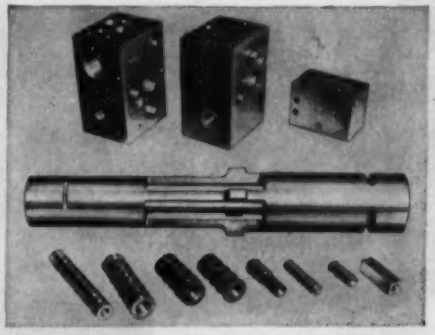
Thomas C Wilson Inc, Long Island City, NY

MORE DATA? Circle 90, inside back cover

"I had no idea he drank until one day he came in sober."

How Cadillac Gage MICROHONES Drilled Bores in Hydraulic Units

Here's how Cadillac Gage Company uses just drilling and Microhoning to secure higher production, reduce costs and obtain high accuracy in producing precision bores for hydraulic units that control gun elevation and traverse of gun turrets on military tanks.



This representative range of sleeves and other hydraulic components include both soft and hardened steels.

MMT-PE

Microhoning Bores in Hard Steel

Following the drilling operation, bores are Microhoned in at least eight different sizes of sleeves that are hardened to 63 R "C". Bore diameters range from .250″ to .875″ and in lengths up to 5.50″. From .008″ to .010″ of stock is removed in an average Microhoning cycle of about two minutes. A surface finish of four microinches, rms, is consistently obtained while generating roundness and straightness within 20 millionths of an inch tolerance over the full length of the bore. Also, because the free-floating Microhoning tool follows the neutral axis of the drilled hole, the bore location remains unchanged.

Microhoning Bores in Soft Steel

Another component of these hydraulic units is a cylinder whose bore is 1.625″ in diameter and 19″ long. Because the maximum stroke of the Hydrohoner machines being used is 15″, the cylinder is turned end-for-end during the Microhoning of the bore. Following a deep-hole drilling, Microhoning removes from .012″ to .015″ of stock in generating a controlled surface finish and correcting geometric inaccuracies.

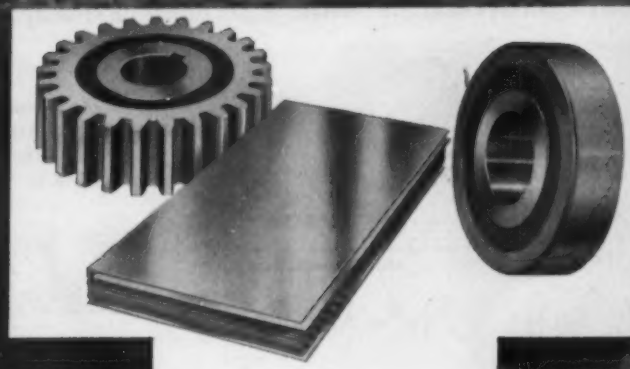
Microhoning Blind-End Bores

In addition to bores in hardened steel sleeves and soft steel cylinders, Cadillac also Microhones several bores in soft steel valve bodies. One of these is a blind-end bore. It is .625″ in diameter, 1.75″ long and has a $\frac{1}{16}$″ relief at the bottom. Microhoning is specified to hold geometric tolerances within .0001″.

In the processing of precision bores in a variety of components for hydraulic units, Cadillac Gage is giving versatile and tangible expression to "precision production through Microhoning."

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

VALVOLINE
Tectyl
protects metals against RUST



VALVOLINE'S amazing Tectyl rust preventives protect metal surfaces against *rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against the effects of snow and rain... salt air, humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

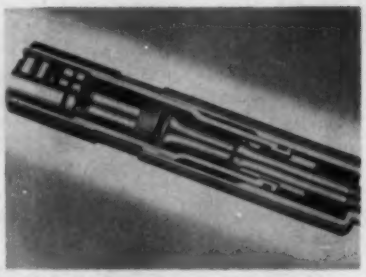
Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy, Air Force and other Government Agencies' specifications and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the industrial field.

VALVOLINE **Tectyl** RUST PREVENTIVES

VALVOLINE OIL COMPANY, Petrolia, Pennsylvania

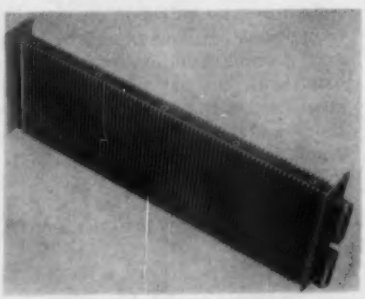


Liquid Spring Has Flat-Topped Energy Absorbtion Curve

Taylor Model 1040SS Liquid Spring Shok produces spring action by liquid compression between sealed area at stud head and sealed area of tubular piston. Net liquid compression is 20,000 psi. Shock force is produced by inwardly turned dash pot head at tubular piston end plus inertia valve area. Average maximum force of 6000 lbs produces flat-topped enengy absorbtion curve for maximum energy absorbtion at minimum force with declining velocity and cam slopes.

Taylor Devices, Inc, 188 Main St, North Tonawanda, NY

MODE DATA? Circle 91, inside back cover



Cold-Plate Heat Exchangers Incorporate Advanced Design

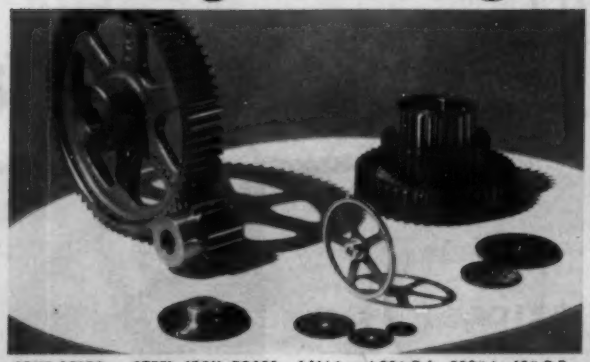
Originally developed for inertial guidance systems, these compact units provide higher thermal efficiencies and lighter weight than conventional heat transfer equipment, according to manufacturer.

Unit pictured utilizes corrugated aluminum strips brazed to the faceplates to provide conductive media for the flow of liquid or gaseous coolants. Maximum air pressure drop is 3.46 in. H_2O at a rated airflow of 2 lb per minute at an ambient temperature of 160 F. Minimum heat removal capacity is 8.5 Btu per minute (150 w). It weighs 3 lb 6 oz.

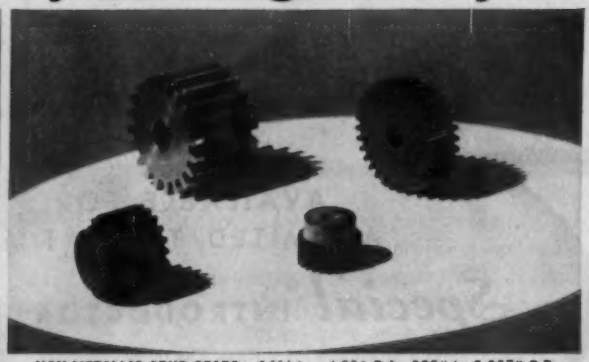
Horkey-Moore Associates, 24660 Crenshaw Blvd, Torrance, Calif

MORE DATA? Circle 92, inside back cover

Design around gears you can get today

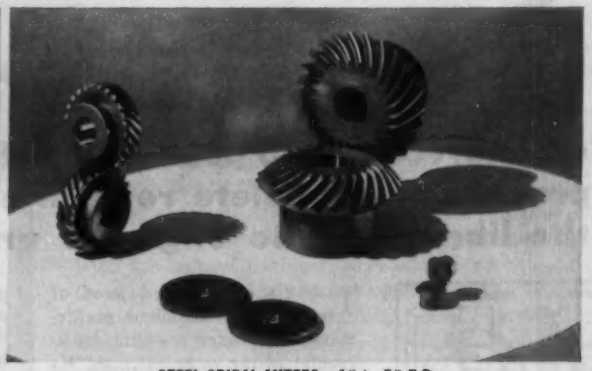


SPUR GEARS — STEEL, IRON, BRASS 14½° and 20° P.A. .208" to 40" P.D.

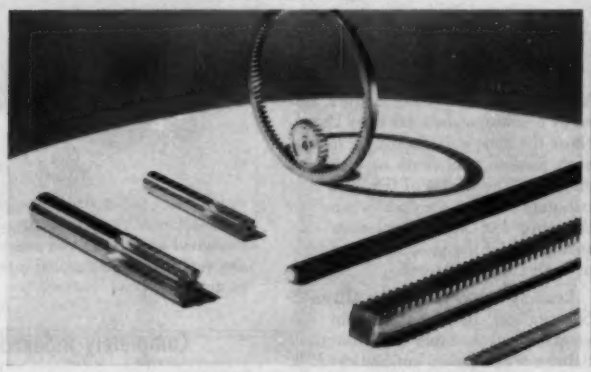


NON-METALLIC SPUR GEARS 14½° and 20° P.A. .938" to 6.667" P.D.

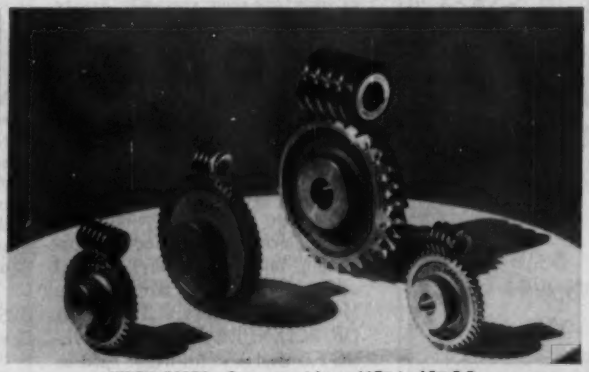
BEVEL and MITER GEARS Steel, Iron, and Brass 20° P.A. .312" to 14" P.D.



STEEL SPIRAL MITERS 1" to 5" P.D.
HELICAL GEARS Steel and Bronze .333" to 6" P.D.



RACK • PINION WIRE Steel and Brass 14½° and 20° P.A.
PINIONS • INTERNAL GEARS



WORM GEARS Bronze and Iron .417" to 18" P.D.
WORMS .333" to 4" P.D. Soft steel and hardened and ground steel

Build it better...for less...without delay

Design around standardized BOSTON Gears FROM STOCK is the quickest (and lower-cost) way to get your project "off the board" and in production — whether it's a prototype, a product for resale, or new equipment for your own plant. Catalog No. 57 lists over 2000 gears.

Your nearby Distributor will help you simplify planning and show you how to get the biggest benefits from BOSTON Gear standardization — in lower costs, in easier maintenance, in simplified servicing. Boston Gear Works, 60 Hayward St., Quincy 71, Mass.

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FROM STOCK
AT FACTORY PRICES

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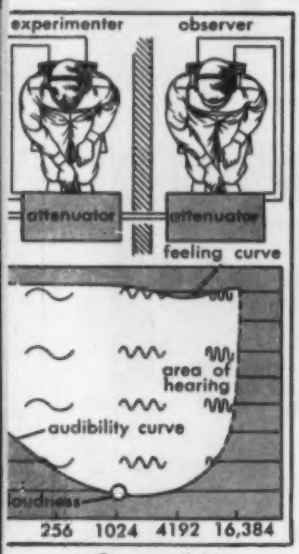

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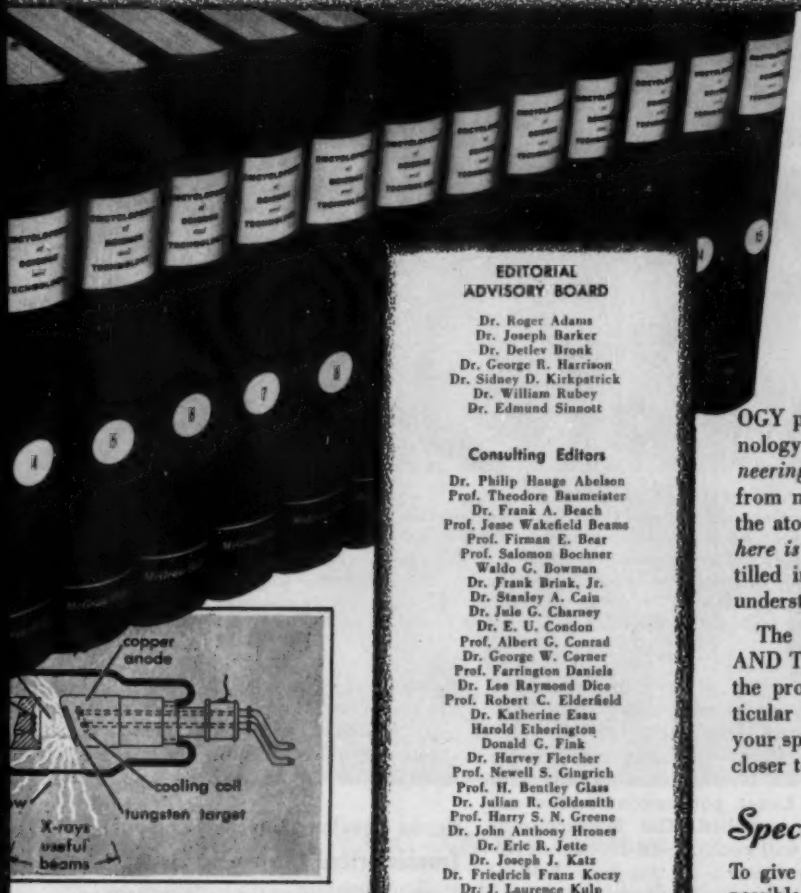
• 15 volumes • over 2000 contributors • 9300 pages • 7200 articles

for SCIENTISTS for TECHNICIANS

. of Science and Technology



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• 8700 illustrations

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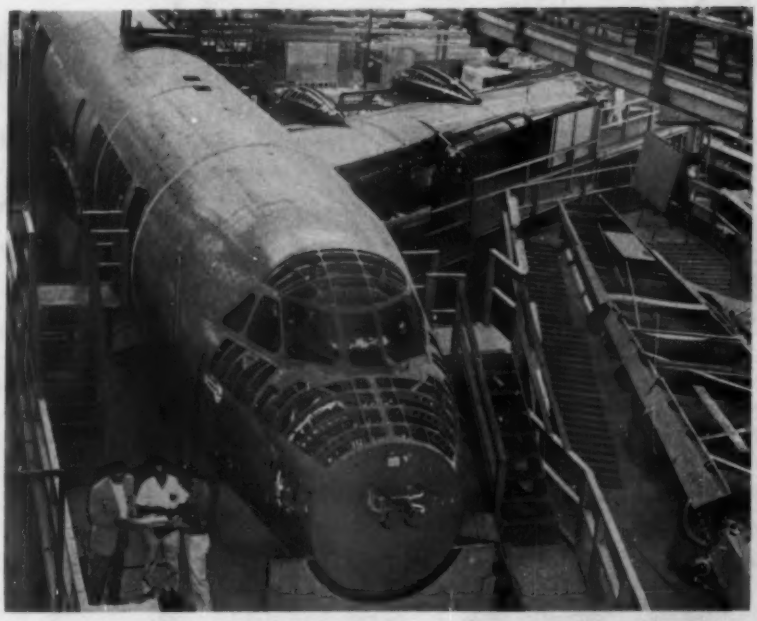
FIELD REPORT...

Dura-Bond Short-Cuts Bearing Manufacturing Process

Dura-Bond Bearing Co, Palo Alto, Calif, has purchased over $100,000 worth of new automatic machinery that'll boost output of ball bearings from 6 million annually to 10 million at its expanded facility.

Firm has developed its own cam-bearing manufacturing process which starts with 5-ft lengths of steel tubing. Molten babbit metal is applied to the inside of the tubing by a high-speed centrifugal process. After cooling, the pipe is cut into bearing lengths which are machined to a mirror finish to a tolerance of 0.0001. The bearings are used principally for replacement in rebuilding automobile, truck, tractor, and marine engines, both gasoline and diesel-powered, rather than as original parts. Company also manufactures cylinder sleeves and sleeve assembly sets.



Metal mockup of the Convair 600 jet airliner is in use at Convair (San Diego) Division of General Dynamics Corp. Built in production fixtures, it'll be retained throughout the life of the manufacturing program to prove out design changes for individual customers and to insure uniformity of electrical wiring, tubing, hydraulics lines, flight controls, and instrumentation. Speed capsules or aerodynamic anti-shock bodies on the upper surface of the wing will help the 600 to achieve its 635-mph speed; wing leading edge slats will enable it to land and take off in shorter distances

$20.5 Million Nike Contract . . .

. . . has been awarded to Western Electric Co by the Army. Work will be carried out in company plants at Burlington, Greensboro, and Winston-Salem, NC; the General Electric plant at Syracuse, NY, and by Douglas Aircraft at Santa Monica, Calif.

GE Building Big Plant For Resin Manufacture

First self-contained polycarbonate resin manufacturing plant in the US is being built on the Ohio River near Mount Vernon, Ind, by the Chemical Materials Dept of General Electric Co. Facility is expected to be in operation in the third quarter of the year. It'll house reactor units, plus extrusion, finishing, and shipping area.

The multimillion-dollar, multimillion-pound per year commercial plant is the outcome of semi-works and pilot plant facilities that have operated since early 1957 at Pittsfield, Mass, and from which more than 200 production applications for GE's Lexan polycarbonate resin are being supplied. The Massachusetts unit will continue in further development work in this new field of premium-property plastics, pioneered by GE in this country.

Bendix Drops Aviation From Name

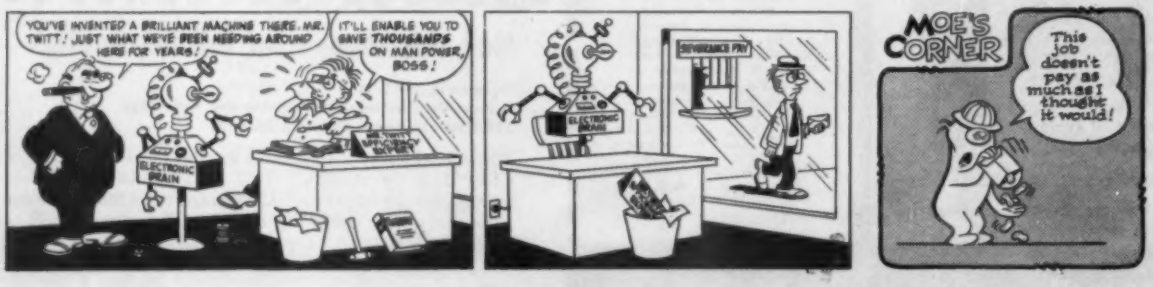
As of June 1, Bendix Aviation Corp will be known as Bendix Corp. The organization is engaged in the manufacture and sale of not only aviation products but of a large number of automotive, electronic, nuclear, missile and space, marine, machine tool, and industrial products. Bendix automotive business alone amounted to $114.3 million last year.

Narda Develops Lowcost, Compact Transistorized Ultrasonic Cleaner

Narda Ultrasonics Corp, Westbury, NY, has come out with the UniBlast, priced at under $100, for cleaning small items. It'll handle anything from tiny semiconductors to clocks, and can be used in the home for cleaning do-it-yourself tools, jewelry and silverware, as well as contact lenses or dentures. Unit's base houses the generator and a recessed circular

McGIRK'S WORKS

by GEO. CRENSHAW


YOU'VE INVENTED A BRILLIANT MACHINE THERE, MR. TWITT! JUST WHAT WE'VE BEEN NEEDING AROUND HERE FOR YEARS!
IT'LL ENABLE YOU TO SAVE THOUSANDS ON MAN POWER, BOSS!
ELECTRONIC BRAIN
ELECTRONIC BRAIN
MOE'S CORNER
This job doesn't pay as much as I thought it would!

How to make large stampings more profitably with **AUTOMATIC PRODUCTION**

Minster Progress-O-Matic handles extremely wide coil (up to 30" width on this 150 ton press) you get full value from material, less scrap, greater tooling flexibility, multiple parts production, more profit.

Photos courtesy of Inland Steel Container Company, Division Inland Steel Company, Jersey City, New Jersey

Minster Progress-O-Matic Presses

. . . make big progressive die parts automatically at high speeds.

. . . eliminate secondary operations on several presses.

. . . give you more parts per stroke when you double up parts or nest parts on wide material.

. . . have twin-drive gears . . . greater capacity above bottom of stroke for draw work and heavy material blanking.

. . . have feed built in uprights close to die, allows close control and support of material.

. . . capacity range 150 to 500 tons.

Talk to your Minster representative about the Progress-O-Matic press or write us for more details.

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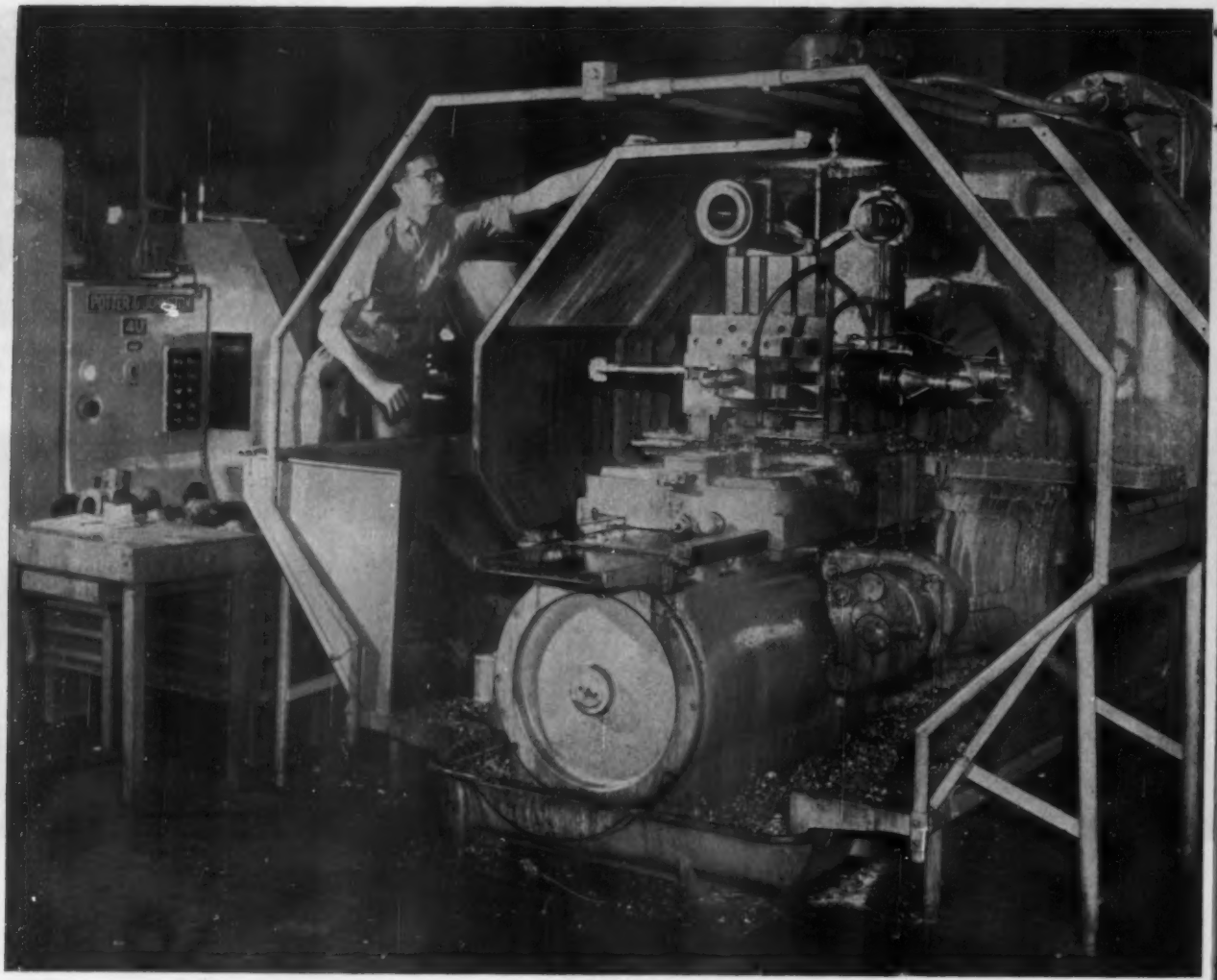
"Valve Bodies machined

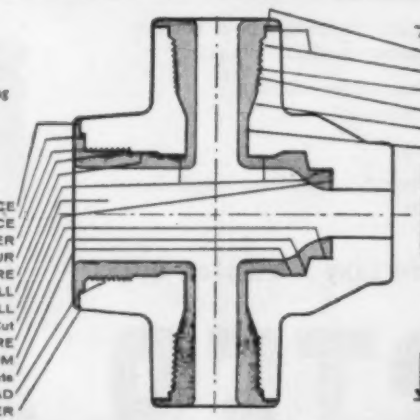


JOB FACTS

THE PART: Plug Valve Body
MATERIAL: 4140 Steel Casting, 287-301 Bhn
REQUIRED: A total of 33 roughing and finishing cuts, involving very heavy metal removal.
THE MACHINES: A Potter & Johnston 6DREL-40 and a Potter & Johnston 4-U.

FIRST OPERATION

FACE
FACE
CHAMFER
FORM CONTOUR
COUNTERBORE
STEPPED CORE DRILL
PILOT BORE FOR DRILL
FACE, Single Point Cut
BORE
FACE BOTTOM
FORM CONTOURS, Single Point Cuts
STRAIGHT THREAD
CHAMFER



SECOND OPERATION

FACE, Single Point Cuts
STEPPED CORE DRILL
FORM TAPER, Single Point Cut
TAPER THREAD
FORM CONTOUR, Single Point Cut
CORE DRILL

THIRD OPERATION

(Index and repeat operation on opposite end.)

THE RESULTS

A part completed every 6½ minutes- a time saving of 80% over previous methods. The first operation is performed on one machine. While this is working, the other machine is loaded, and the second and third operations are completed.

SHADED AREAS INDICATE METAL REMOVED

in One-Fifth the time

...plus attractive savings in set-up time!"

Two Potter & Johnston Automatic Turret Lathes . . . a Model 4-U and a Model 6DREL-40 recently installed in the Mission Manufacturing Company's plant at Houston, Texas . . . are now producing plug valve bodies in 20% to 50% of the time previously required using hand turret lathes. Widely used in oil field and chemical industry applications, these valve bodies are machined from heavy steel castings. The multiple machining operations require very heavy metal removal, demand close tolerances and, in addition, involve the generating of complex internal contours. Looking for a means of speeding up these machining operations, Mission investigated Potter & Johnston and other makes of machines. P&J Automatics were finally selected, because they are sturdier and heavier and because of the extreme savings in the set-up time for the various jobs. Other factors influencing Mission's choice include the accuracy of the P&J Machines, the savings in floor space made possible by their high output-per-area, and the fact that their completely automatic operation insures greatly increased production per man-machine hour.

Combining extra power and rigidity for fast metal removal with the versatility needed to handle complex multiple cuts with speed and efficiency, Potter & Johnston Automatics can increase productivity and cut costs at your plant the same way they have at the Mission Manufacturing Company. For the dollars-and-cents facts, ask for production estimates on your jobs. Call the Pratt & Whitney Branch Office in your area or write direct, outlining your production needs.

PRATT & WHITNEY COMPANY, INC.,
11 Charter Oak Boulevard, West Hartford, Conn.

POTTER & JOHNSTON AUTOMATICS
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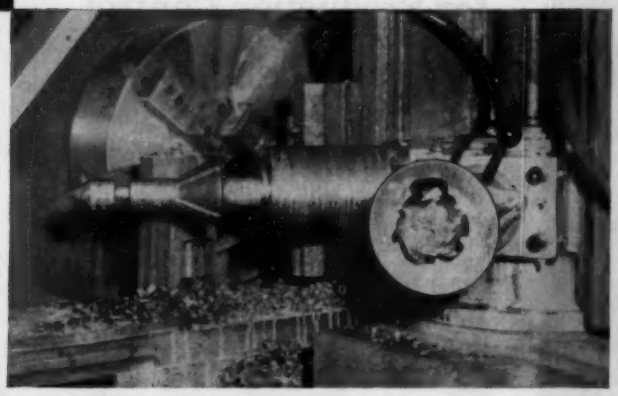
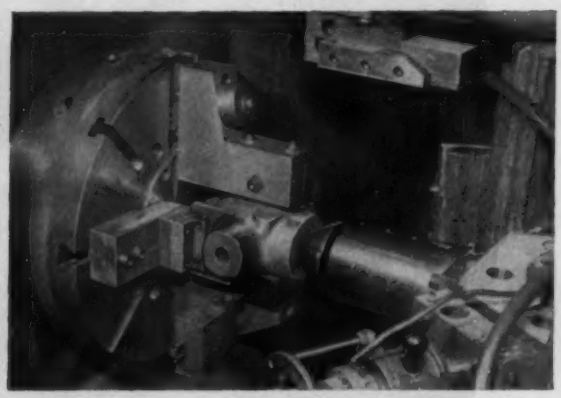
100th Anniversary 1860 1960

PRATT & WHITNEY®
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES • CUTTING TOOLS



Heavy metal removed fast . . . contributes to the important time savings realized on this job. Heavy cuts like this require unusually powerful, rigid machines, like the P&J 6DREL-40 and 4-U.



Important savings in set-up time . . . are realized because this tooling, designed by P&J Specialists working with the manufacturer, incorporates an unusual degree of versatility and adaptability.

Field Report . . .

barium transducer upon which is placed a 400-milliliter beaker containing the cleaning solution. The transducer sets up the sound waves. UniBlast plugs into an ordinary 110-120 volt circuit.

Illinois Tool Buys ACF Line

Illinois Tool Works, Chicago, has purchased all manufacturing rights to the electronic module and capacitor components developed by ACF Industries Inc for use in radio and television circuity and various defense projects. The Alexandria, Va, facility where the devices are manufactured is included in the transaction. It'll be operated as the Paktron Division under the direction of Silas S Cathcart, vice president.

Two divisions of Illinois Tool are currently engaged in manufacturing components and parts for the radio and television industries. The Licon Division in Chicago produces precision electrical switches and controls; Pascal Division in Hawthorne, Calif, manufactures rotary solenoids and switching devices.

Mesta to Build Huge Plate Mill

Mesta Machine Co, Pittsburgh, has a contract to design and manufacture the world's largest and the first plate mill installation arranged to operate as either a 160 or a 210-in. mill. Designed to roll plate from reheated slabs or hot slabs weighing up to 70,000 lb directly from a slabbing mill, the new facilities will be installed at the Gary Steel Works of US Steel Corp. In order to arrange the plate mill for 160 or 210-in. capacity, both housings will be shifted on sliding shoe plates to maintain the same mill centerline. It'll be powered by two 6000-hp direct drive motors.

RCA Gets $474 Million Contract

Order placed by the Air Force nearly two years ago has been made formal by award of a contract to Radio Corp of America for work involving the Ballistic Missile Early Warning System in the Far North. Work on BMEWS, which is designed to give the nation about 15 minutes' warning of a ballistic attack through huge radar apparatus located on the fringe of the Arctic Circle, is being done at the Moorestown, NJ, plant and other RCA installations throughout the country. RCA is the prime contractor for BMEWS; Western Electric is the prime contractor for the communications network that'll tie in the system with AF control centers. Among RCA subcontractors are Goodyear Aircraft, General Electric, Sylvania Electric Products, and some 100 smaller firms.

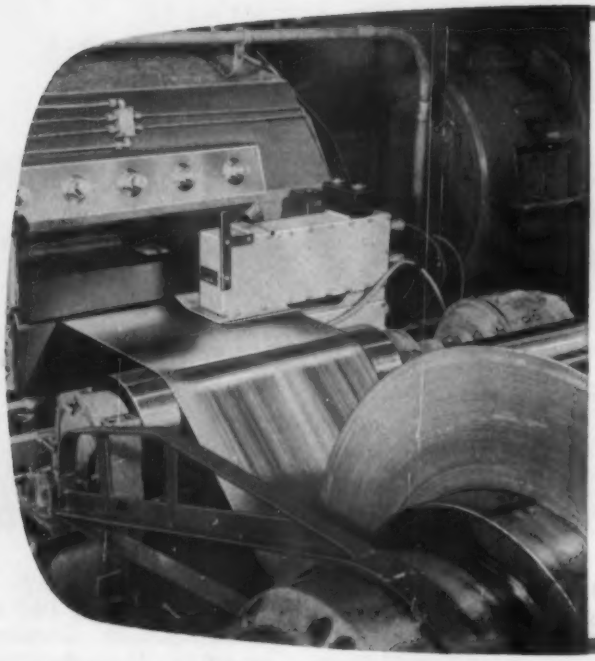
Jet-Propelled Boats . . .

. . . will be produced by Inboard Boat Co, recently formed in Richmond, Calif. Production is starting this month at the new company's plant on the Parr Industrial Corp property in Richmond; about 100 workers are being employed. Six different models will be turned out—first will be a 20-ft propellerless craft with fiberglass hull.

Ex-Cell-O Acquires Kodak's Contour Projector Business

Ex-Cell-O Corp of Detroit has purchased Eastman Kodak Co's contour projector business through acquisition of Optical Gaging Products Inc of Rochester, NY, the sole marketing agent for the projector in the US and

ACCURACY ASSURED...



CONTINUOUS Gages for Production Control

Pratt & Whitney Continuous Gages and Control Units can help you improve product quality and accuracy, increase rolling speeds, eliminate scrap losses due to under- and over-size rolling, reduce costs, and increase profits. Wire, tin plate, foil, steel, non-ferrous alloys, paper, plastic, rubber, and other strip-produced materials . . . you'll find the right gaging equipment for every application in the complete P&W line that includes: Both contacting and non-contacting continuous gages and a wide variety of control units to provide automatic size control, classifying, sorting, or recording.

100th Anniversary 1860 1960

FIRST CHOICE FOR ACCURACY

PRATT & WHITNEY

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Canada. Under terms of the purchase Ex-Cell-O acquires Kodak's inventory of completed projectors, those under construction, and some production tools as well as certain patents relating to the instruments.

Ex-Cell-O, a manufacturer of machine tools, packaging equipment, gages, precision parts and assemblies, will manufacture the complete projector line and market it under the Ex-Cell-O name.

$8 Million Contract to Burroughs

Burroughs Corp, Radnor, Pa, has an AF contract for equipment that will be used to convert radar signals into digital form for automatic computation. Two sets of the converters are used at each SAGE site in North America to pinpoint aircraft move-

Japanese Electric Firm To Expand US Markets

Officials of Tokyo Shibaura Electric Co Ltd are touring North and South America to explore possibilities of expanding the large Japanese electrical and electronics producer's markets. They'll visit several companies with which Toshiba (as it's widely known) has production or sales agreements including GE, RCA, Sperry's Remington Rand Division, Capitol Records, and United Engineering & Foundry Co. GE's foreign marketing subsidiary, International General Electric Co, owns more than 7% of Toshiba's outstanding stock.

Japanese transistorized radios and transistors are arriving in this country in rapidly increasing numbers. Electronics Industries Association reports that imports of Japanese-made transistors in the first nine months of 1959 reached 1,828,981 compared with 10,620 in all of 1958. Imports of Japanese radios with three or more transistors jumped to 2,450,263 in 1959's first nine months from 1,233,548 in all of 1958.

Dumont Mfg Corp Expanding

Dumont, a subsidiary of Dutron Corp, and a fabricator of high-temp plastic materials, is occupying new facilities next to its manufacturing complex in San Rafael, Calif, and has installed a new 2000-ton press, one of the largest on the west coast, for compression molding of large missile components. Firm's manufacturing space is now 61,000 sq ft compared with 35,000 a year ago, and this is the seventh new press to be installed within the past seven months.

Giant Grip's Forging Operations Taken Over by Kropp Forge

Kropp Forge of Chicago has acquired the job forging operations of Giant Grip Manufacturing Co, Oshkosh, Wis. Transaction includes approximately 500 active steel forging dies. Giant's forging operations have amounted to approximately $1 million a year in sales and company currently has a substantial backlog of unfilled orders.

Kropp has, in addition, acquired a major forging contract from Crane Co, Chicago, which recently discontinued its forging operations.

ISA Establishes Annual Award

Instrument Society of America will present an annual award to an ISA member making "the most important technological contribution to the conception and implementation of a new principle of instrustrument design, development or application." Consisting of a cita-

with PRATT & WHITNEY GAGES

DATA·LIMIT*

for Quality Analysis

Modern quality control demands complete, dependable records for all continuous production. To meet this need, P&W now offers the DATA-LIMIT Production Quality Analyzer. Operating from any P&W Continuous Thickness Gage, this unit provides a printed record of the number of good, undersize, oversize, and total feet; the tolerance limits; the coil number; and the time and date. The Analyzer is compact and portable, readily moved to any mill. Electromechanical in operation, it provides complete dependability and costs far less than other units.

For additional information on the DATA-LIMIT Production Quality Analyzer or P&W Mill Gages and Control Units, write today, outlining your application requirements. Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Conn.

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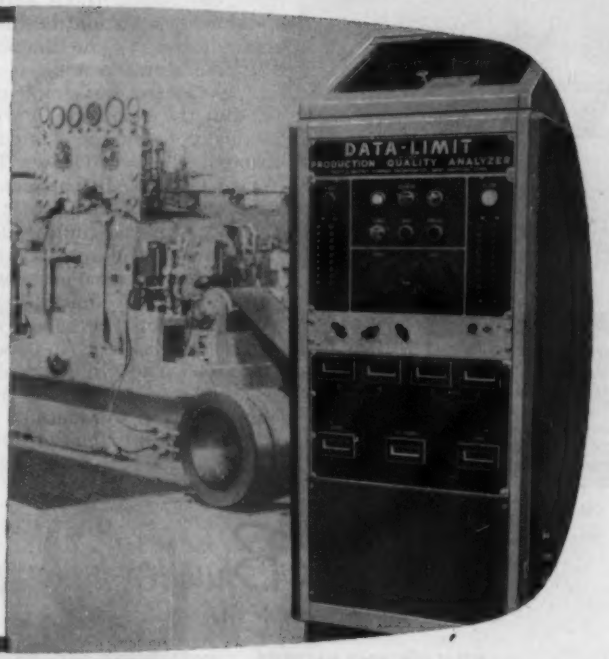


"JOB ENGINEERED" MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE 277 READER SERVICE CARD

OSBORN

BEFORE BRUSHING
Insulation residue on this small, copper electric motor commutator was a knotty, costly cleaning problem. Rate: 800 per hour.

AFTER BRUSHING
Surface quality-finished . . . insulating material and feather burrs gone . . . ready for trouble-free assembly. Rate: 3500 per hour.

Production soars from 800 to 3500 pieces per hour

...with OSBORN power brushing

PRODUCING at the rate of 3500 pieces per hour (over 330% greater than former off-hand method) these Osborn TY₂ Master₂ Wheels remove troublesome phenolic-type residue from electric motor commutators at Dayton Precision Manufacturing Co.

Slow, off-hand methods were being used to remove insulation residue from these commutators. Production was costly . . . parts lacked uniformity.

A specialized, but simple machine now handles the operation. Parts are automatically fed along a guide tube and through a pair of Osborn TY₂ Master₂ Wheel brushes. In this centerless type finishing setup—the job is done effectively in pre-set time cycles. Results: production and quality up—rejects eliminated . . . time and costs down.

Cleaning and finishing problems in your plant can be solved with similar production savings. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no cost or obligation—is the first step. Write us for full details. *The Osborn Manufacturing Company, Dept. C-96, Cleveland 14, Ohio.*

Osborn Brushes

METAL FINISHING MACHINES . . . AND FINISHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY

190 CIRCLE 278 READER SERVICE CARD

Field Report . . .

tion and a cash award of $1000, it'll be named in honor of Dr Arnold O Beckman, former president of the Society and one of its Honorary Members.

The contribution of each nominee for the first award, which will be made at the Society's annual meeting in New York in September, must have been described substantially by at least one published paper, patent, or unclassified formal report bearing a date falling within the two-year period ending Oct 31, 1959. Nominations are being received by William H Kushnick, executive director of ISA at its headquarters, 313 Sixth Ave, Pittsburgh, Pa.

Valiant Seats in Tennessee

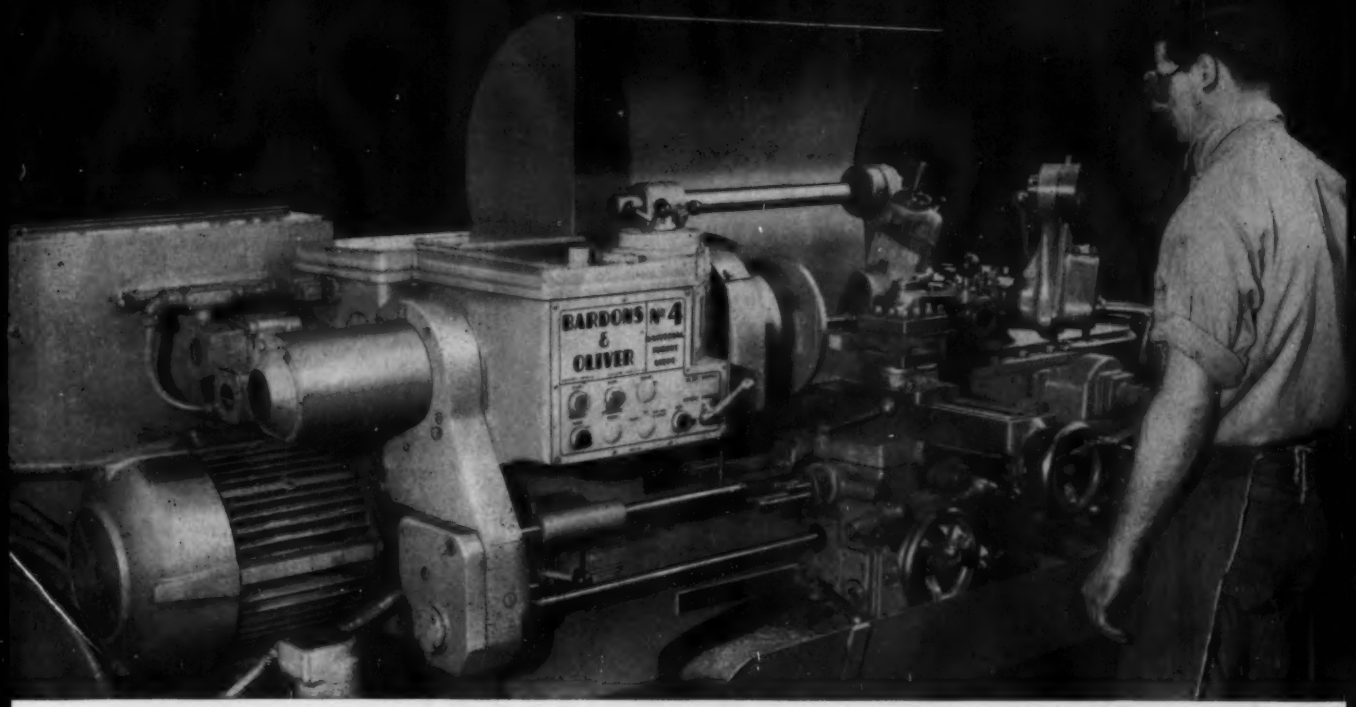
American Metal Products Co's Union City, Tenn, plant will soon begin manufacture of front and rear seats for Chrysler Corp's Valiant. Facility, with current workforce of 600, expects to add another 100 to handle the new line.

Terrier Contract to Convair

Convair (Pomona, Calif) Division of General Dynamics Corp has a $25.2 million order from the Bureau of Naval Weapons for additional production of advanced Terrier guided missiles. The supersonic surface-to-air antiaircraft weapons will be produced at the Naval Industrial

"I don't even let what he says go in one ear!"

CIRCLE 279 READER SERVICE CARD ▶



BARDONS & OLIVER NO. 4 TURRET LATHE

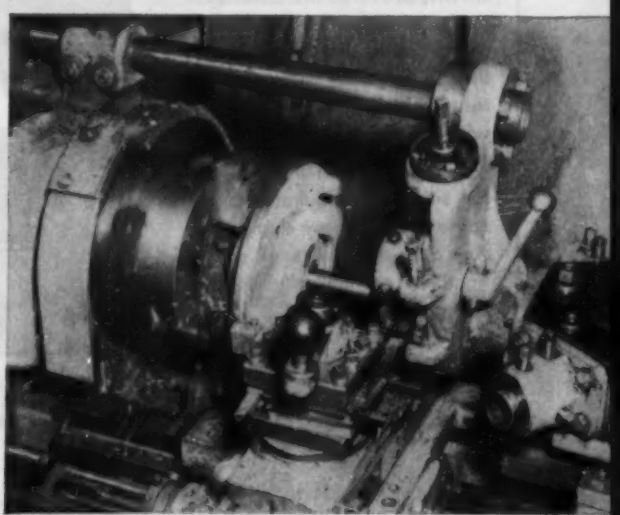
"Biggest Money-Maker in the Plant"

Reports W. W. McCain, Jr., Factory Manager, Chicago Machinery Laboratory, Inc. This progressive firm manufactures automatic signature feeders and magazine trimmers. Mr. McCain further states:

"The addition of the No. 4 Bardons & Oliver has allowed us to reduce direct labor in the turret lathe department, and at the same time increase output by 50%. Over 600 different parts are made on the machine. Extreme accuracy of the No. 4 allows us to hold bearing diameters within ±.00025"; at the same time high spindle speeds, heavy feeds, and combined and multiple cuts allow full utilization of the 15 HP main drive motor. The machine is very convenient to setup and operate. During two years of 100 hours a week operation, downtime on the No. 4 has been negligible.

We feel that the Bardons & Oliver No. 4 is the most compact and efficient turret lathe available having 18" swing over the bedways. By making a totally different turret lathe for each range of work, Bardons & Oliver offers just the right size machine for any job."

Your Bardons & Oliver representative will welcome the opportunity to discuss with you the profit possibilities offered by these turret lathes.



Rough turning & boring 11-1/2" O. D. cast iron cam follower wheel.

BARDONS & OLIVER

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

ONLY

GOSS and DeLEEUW AUTOMATIC CHUCKERS

offer the 1-2-3 feature

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.

The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS & DeLEEUW

GOSS and DE LEEUW MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Field Report . . .

Reserve Ordnance plant operated for the Navy by Convair. Convair/Pomona has been developing and producing Terriers for the Navy since 1954. Newest version has greatly improved effectiveness against low-flying aircraft and multiple targets. In addition to fleet units, Advanced Terrier will also arm Marine Corps detachments.

Bliss & Laughlin Takes Over Sierra Drawn Steel Corp

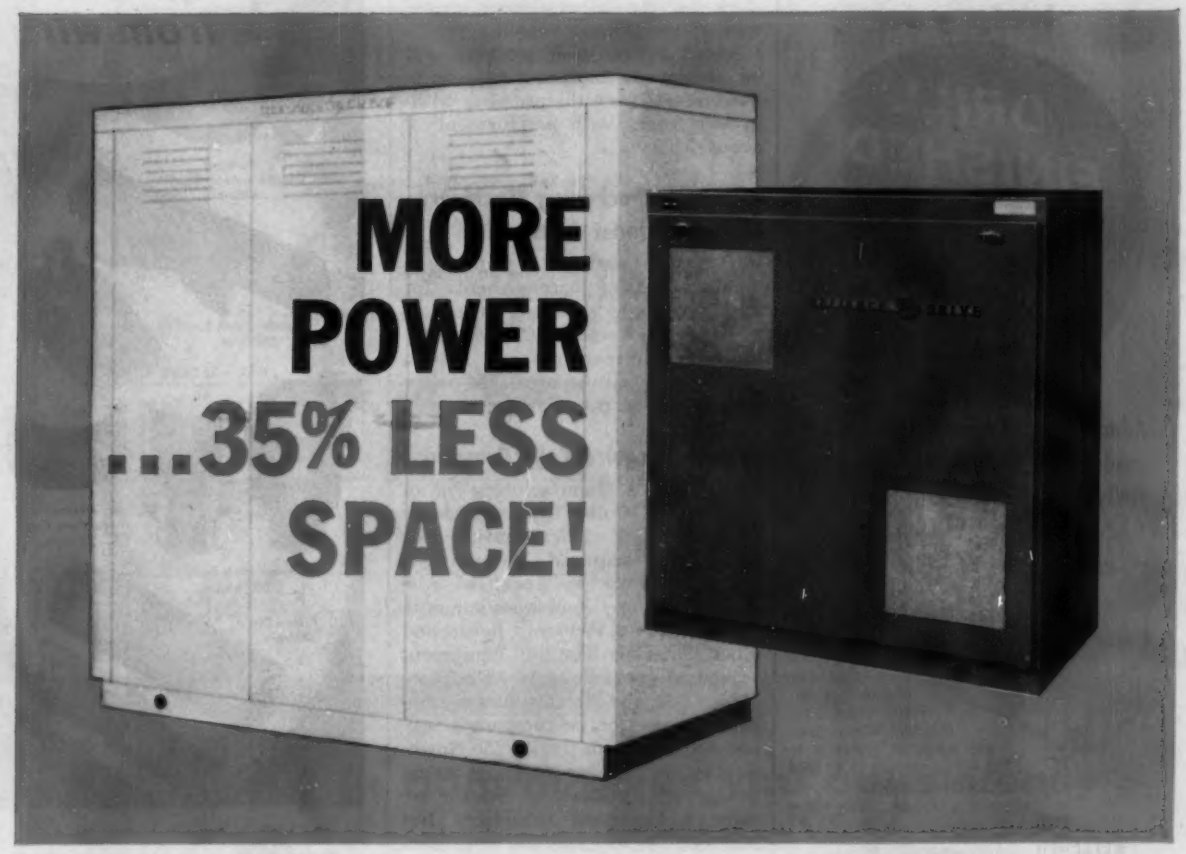
B&L, through stock exchange transaction, has acquired Sierra, a major West Coast producer of cold finished steel bars with mills in Los Angeles and Seattle. Company will be operated as the Sierra Drawn Division of Bliss which, as a result of the acquisition, is extending its operations to the Pacific Coast for the first time since it was established in 1891. B&L has mills in Harvey, Ill; Buffalo; Detroit; and Mansfield, Mass.

Spacetronics Moving to Florida

Spacetronics Inc, which has been located in Washington DC, has leased 14 acres of land with 1000 ft of river frontage on the Halifax River in Daytona Beach, Fla, for development of the hydro air vehicle invented by Carl W Bollum Sr, president of the company. Firm is setting up an R&D lab and will work on models for the Marine Corps and for Southern Airways which is thinking of using two of the boats for cargo

"I'm giving you a two-dollar raise, Hollis. I want your last week here to be a happy one."

Reliance Super 'T' V★S Drives



Both of these control units are rated at 50 horsepower! Actually, the new, small Super 'T' V★S cabinet packs more punch!

LIKE the Reliance Super 'T' Drive Motor, new V★S power units utilize Class B insulation, permitting a more compact unit. 100% overloads of one minute duration are accomplished without failure! Advanced design of ventilation keeps control and power units cooler . . . another reason why smaller size is possible. And service life is substantially extended.

Matched system design of drive motor, power unit and controls produces a highly efficient, integrated drive—to give you a wide range of stepless, variable operating speeds from a-c. circuits.

Super 'T' V★S Drives are available for immediate delivery. Check your Reliance salesman for delivery schedules on the full line, 1—350 hp., Bulletin Number D-2506, has been prepared to give you complete information. Write for it. D-1641

Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

RELIANCE ELECTRIC AND ENGINEERING CO.

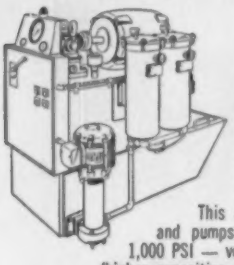
DEPT. 13A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.

SEALOL
GUN DRILLING ACCESSORIES help you

DRILL FINISHED HOLES IN ONE PASS

Adapt your present equipment for modern gun drilling with these specially designed gun drill accessories.



the original HI-PRESSURE COOLANT SUPPLY UNIT

The heart of any gun drilling operation is proper coolant in generous quantities. This unit filters, cools and pumps at pressures to 1,000 PSI — volumes to 40 GPM (higher capacities available).

END ATTACHED COOLANT TRANSFER

Attached to the outboard end of hollow-spindle equipment to transfer coolant to the rotating gun drill. Pressures to 1,000 PSI and speeds to 10,000 RPM.

GUN DRILL ADAPTOR
Not illustrated—for solid spindle equipment. The coolant transfer is integral with the adapter spindle.

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Please ☐ send literature
☐ have representative call

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

Field Report . . .

service to the Bahamas. Alcoa has done a good part of the engineering work on the all-aluminum prototype of the Bollum vehicle.

About 30 research workers will be employed. Company expects to have a factory on the premises within two years with employment of about 300.

Automatic Packaging Machinery Available Under Lease Plan

Nationwide Leasing Co, Chicago, is handling leasing arrangements for all Packomatic machines manufactured by J L Ferguson Co, Joliet, Ill. Both regular machines and custom installations will be available under two, three, or five-year terms.

Lockheed Acquires Colby Companies

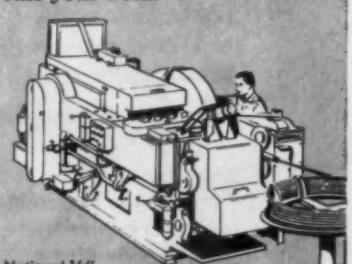
Colby Steel & Manufacturing Inc of Seattle, and Colby Crane & Manufacturing Ltd of Vancouver, BC, have been acquired through exchange of stock by Lockheed Aircraft. The Colby companies annually produce cranes, elevators, hoists, and other materials handling equipment valued at approximately $2 million. This marks the aircraft-missile-shipbuilding-electronics company's second acquisition in the Pacific Northwest in less than a year. Puget Sound Bridge & Dry Dock of Seattle became a Lockheed subsidiary last May. Colby will operate at present locations as a wholly owned subsidiary of Lockheed under the administration of the Puget Sound Co.

"I think your way would be much better, I must say—mustn't I?"

These important parts are cold-formed from coiled wire, start to finish in compact, efficient National Cold Headers.

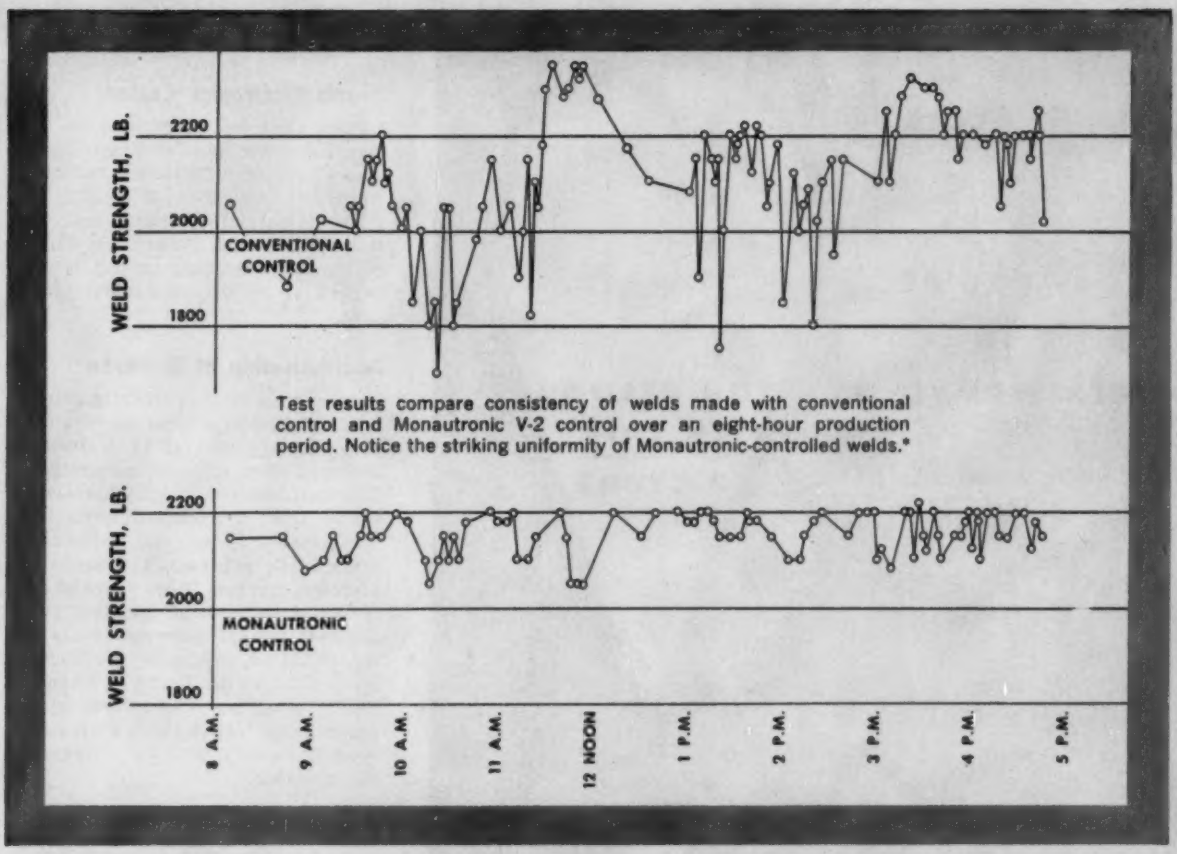
The top three are formed with no scrap loss, ready to use! All six achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.



National ½" Five-Station Progressive Cold Header

NATIONAL MACHINERY CO.
TIFFIN, OHIO, U.S.A.
HARTFORD DETROIT CHICAGO



Test results compare consistency of welds made with conventional control and Monautronic V-2 control over an eight-hour production period. Notice the striking uniformity of Monautronic-controlled welds.*

new feedback control gives you consistently high quality welds . . . automatically

Monautronic V-2 welding control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

The new *Monautronic V-2* welding control makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The control compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures uniform production of high quality welds.

Any metal that can be resistance welded can be welded better with the Monautronic V-2 than with any other control on the market.

For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

*Case study upon request.

2450 Hunting Park Ave. Philadelphia 32, Pa. ■ 12141 Charlevoix Ave. Detroit 14, Mich. ■ 3050 East 11th St. Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

1960
TOOL SHOW and CONFERENCE

DETROIT ARTILLERY ARMORY

APRIL 21ST THRU 28TH

The nation's foremost forum for the advancement of scientific knowledge in the field of tool engineering

for rapid registration forms write:
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE
DETROIT 38, MICH.

THE AMERICAN SOCIETY
'60
OF TOOL ENGINEERS

Field Report . . .

Bendix Electronics Center

Bendix Corp has taken over an 80-acre site in the San Fernando Valley area of southern California and will construct a 650,000 sq ft facility for development of military and industrial electronic systems. First unit of the multi-building project is expected to be occupied early next year.

Apprenticeship at Raytheon

Raytheon Co, Boston, recently graduated its first four-year apprenticeship training class of 34 draftsmen and one office machine serviceman. The men received journeyman certificates from the Massachusetts Department of Labor and Industries. Started four years ago, the Raytheon program provides 10,000 hours of on-the-job training that includes 1400 hours of related classroom study in the fields of electronic technician, machinist, or draftsman. Currently the company has 181 students in apprenticeship training and, during the next 10 months, 80 more will enter the program.

Steel Improvement Gets Forgings Order

Steel Improvement & Forge Co has received go-ahead on production of more than half a million dollars worth of forgings for jet transport components. This brings to over $1-1/4 million the orders currently in hand for forged parts for the Boeing 707, Douglas DC-8, Convair 600, and

"Haverslip, this machine is fully automatic. All you have to do is feed, inspect, degrease, pack and ship!"

CIRCLE 285 READER SERVICE CARD

CIRCLE 286 READER SERVICE CARD ▶

Shanks Unlimited

Already the most versatile Die Heads available, GEOMETRIC STYLE DS, DSA and DD models can be equipped with an unlimited variety of shanks to suit any individual requirement.

Furnished with standard round shank for automatic screw machines, they can be adapted to a great variety of machines by the use of special shanks.

Shanks are easily mounted by inserting two square head screws which also act as aligning screws. Shown above are only a few of the types of shanks designed for special applications.

For further details call your GEOMETRIC distributor or write to...

GEOMETRIC-MORTON

NEW HAVEN 15, CONNECTICUT

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GEO MET RIC

Milford Rivet & Machine Company reports . . .

Precision Parts Ground

20 TIMES FASTER

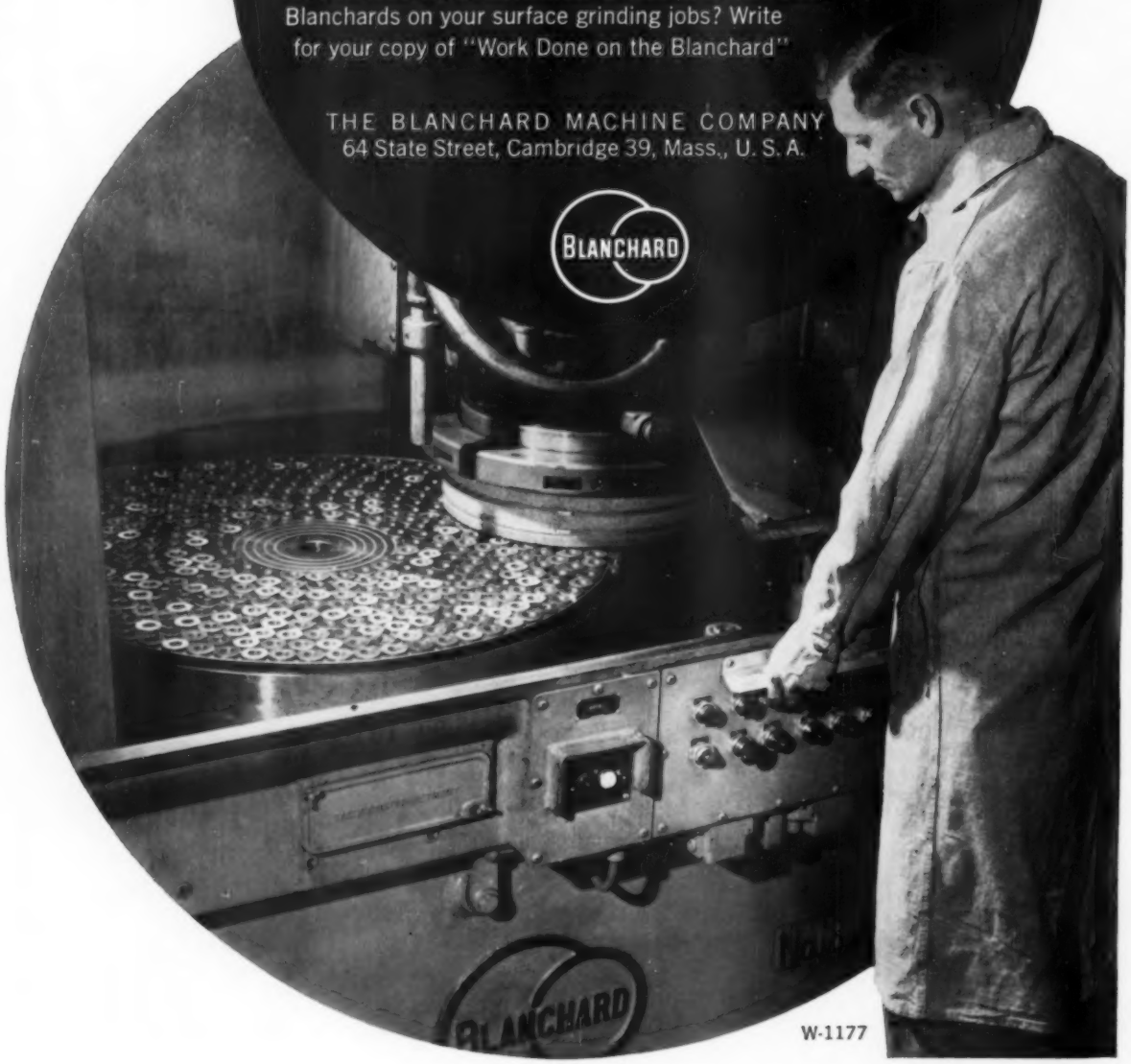
when put on the No. 18 Blanchard

"408 precision washers, in one chuck load, now surface ground in same time as 20 by former method . . . substantial savings on all other Blanchard-ground jobs . . . finished work quality outstanding . . . former sub-contracted jobs now done at less cost in our own shop . . . operator fatigue practically eliminated . . . maintenance is very low."

Are you missing opportunities like these by not using Blanchards on your surface grinding jobs? Write for your copy of "Work Done on the Blanchard"

THE BLANCHARD MACHINE COMPANY
64 State Street, Cambridge 39, Mass., U. S. A.

BLANCHARD



W-1177

Field Report . . .

the KC-135 Air Force jet tanker. Most of this work is scheduled for production in the company's Cleveland plants over the next four months.

AiResearch Turbines for Navy Jets

Navy contract for 286 small gas turbine engines has gone to AiResearch Manufacturing Division of Garrett Corp, Phoenix, Ariz. Company is the world's largest producer of turbines in the 30 to 1000-hp range. Units are for fleet use in providing pneumatic starts for operational Navy jets and will add to the 1500 AiResearch turbines already in Navy use.

Hydraulic Equipment Co . . .

. . . Los Angeles, has been purchased by Sweetland Co of San Francisco. Sweetland has operated in Los Angeles for five years and acquisition will double the size of its operation in the area. Both companies specialize in the design and fabrication of hydraulic and pneumatic systems.

Dow to Invest $30 Million At Louisiana Division

Expansion program at Dow Chemical Co's Plaquemine, La, division will include a plant for production of ammonia, increases in production capacity for chlorine, caustic soda and vinyl chloride, and additions to power and steam generating facilities. Company has an expansion project now in progress at Plaquemine involving investment of $12 million.

"I appreciate how you feel, Figston, but we'd soon go out of business if we paid everybody what they are worth!"

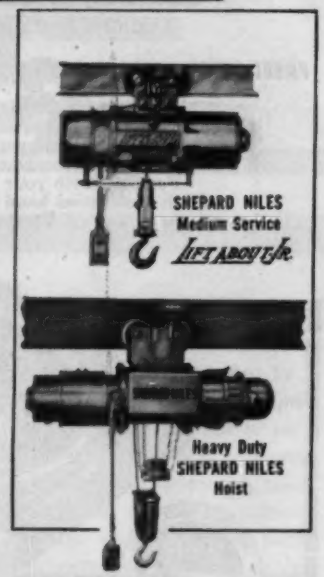
SHEPARD NILES HOISTS

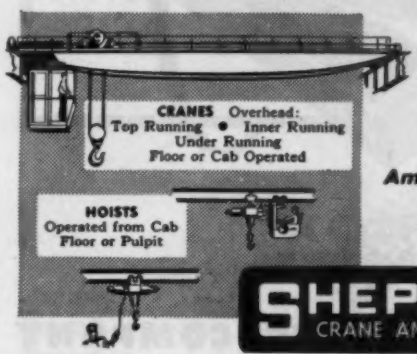
YEARS of SERVICE
WITH TROUBLE-FREE PERFORMANCE

You can be certain of years of thrifty, dependable service when you invest in a Shepard Niles hoist. Long after you have written off the original cost, your Shepard Niles hoist will still be speeding raw materials and work-in-process through the air.

Choose from medium and heavy duty capacities with slow, medium or fast speeds . . . built for cycle duty, heavy intermittent duty, medium duty and light occasional service . . . available with short to long lifts, standard or close headroom, manual or magnetic controls.

Send for illustrated Hoist bulletin today . . . or ask that a Shepard Niles representative call—there's NO OBLIGATION.





Building America's Most Complete Line of Cranes and Hoists Since 1903

SHEPARD NILES
CRANE AND HOIST CORPORATION
3193 Schuyler Ave., Montour Falls, N. Y.

RAY RIVERS, 33 years of service, LENOX chief test man

LENOX *HIGH SPEED STEEL*
band saw blades

Cut faster . . . take greater feeds . . . last longer than conventional sawing methods, the new *LENOX High Speed Steel* Band Saw Blades assure greater production rates. Recommended specifically for special high speed steel band saw machines, these new Lenox blades have performed successfully on some regular band saw machines. Available in standard and hook tooth design.

PROVEN

FREE! NEW HELPFUL HINTS ON HIGH SPEED STEEL BAND CUTTING

New informative product data sheet offers the complete story of Lenox High Speed Steel Band Saw Blades with helpful suggestions on cutting. Write today for Data Sheet No. 1202.
For help with your specific cutting requirements, a high speed steel band saw specialist direct from factory is ready to serve you. Please write or call for immediate attention.

LENOX
THE TOOLS IN THE BLUE AND RED BOX

AMERICAN SAW & MFG. COMPANY
SPRINGFIELD, MASSACHUSETTS • U.S.A.

Field Report . . .

A high pressure polyethylene plant, a major part of the current work, is scheduled for operation this fall. When completed, this most recent expansion will bring Dow's total investment at Plaquemine to more than $100 million.

Norelco X-Ray School Scheduled for June

The 36th Norelco X-ray School will be held at the North Park Hotel in Chicago the week of June 13 to 17. Sessions are sponsored by Philips Electronic Instruments, Mount Vernon, NY. Registration for the course which will cover X-ray diffraction, diffractometry and spectrography, is open to metallurgists, chemists, physicists, production supervisors, quality control engineers and others interested in applications of these techniques. Participants have an opportunity to discuss their own applications and to become familiar with all types of equipment.

Liquid Rocket Engine Order

A $2 million contract for development of a pre-packaged liquid rocket engine has been signed by Navy's new Bureau of Naval Weapons and Thiokol Chemical Corp. The Guardian III contract covers complete development of an engine with over

"I wish you'd stop embarrassing me by telling everyone in the office I made you what you are today."

twice the power of the Guardian II engine now in production along with the Guardian I at the Reaction Motors Division production plant in Bristol, Pa.

$25 Million Contract . . .

. . . from the Navy has been received by Temco Aircraft, Dallas, for continued development and flight test work on the Corvus air-to-surface attack missile. Corvus is being developed under the weapon system concept with Temco responsible for procurement of all components and support equipment.

MEMOS

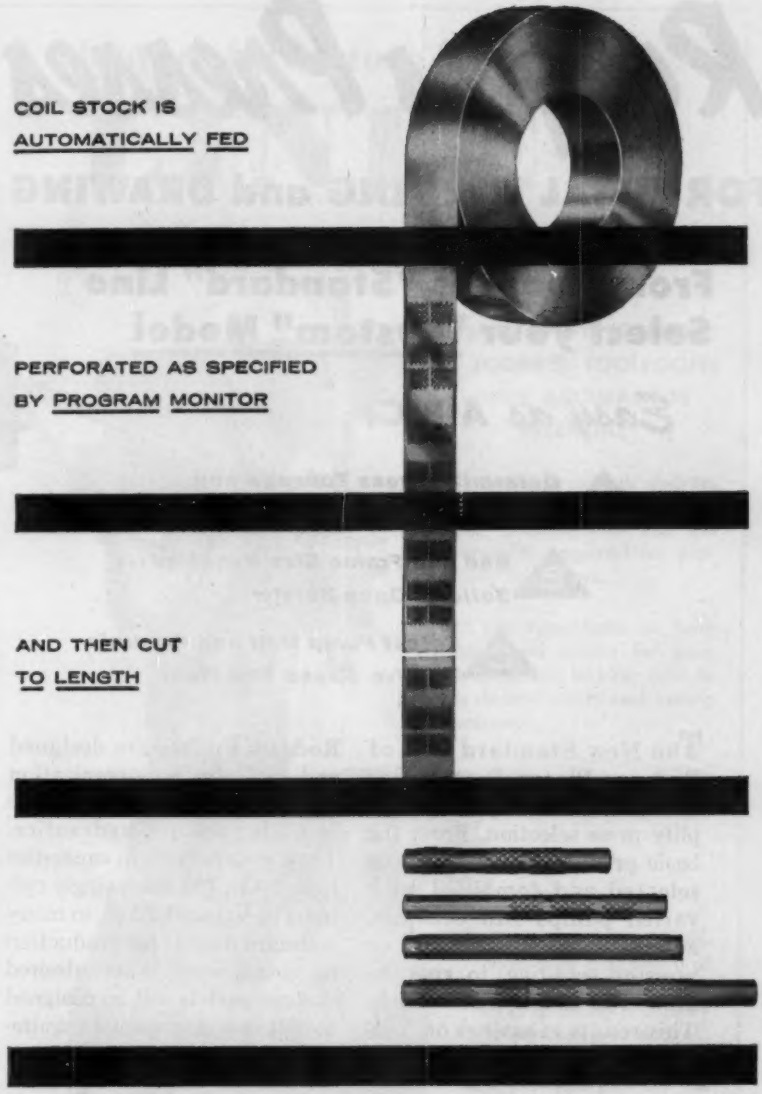
by BESS RITTER

When a metal weapon kills a person, according to many primitive peoples, it's important to destroy the instrument at once, for it now has the magical power to carry death with it for ever and ever.

This is why the aborigines of Western Victoria always take the greatest pains to secure the spear that has caused the death of a relative, no matter how vicious the murdering enemy happens to be. Then the point of the metal instrument is very carefully blunted.

This is also why the Akikuyu of British East Africa confiscate any metal spear or sword that's been used by a murderer to commit his crime. Then the weapon is beaten until the sharpness disappears, and it is thrown into the deepest section of the nearest river.

The natives of Western Australia also destroy the sharp point of any metal weapon that has killed a man, but their reasoning is different. They believe, it is claimed, that the dead man's soul will cling to the point and cannot be freed unless the point itself is also destroyed. This is done by burning it until it's dull.



PROGRAMMING WITHOUT TAPE WITH ONE SET OF TOOLS

Skip punching device, actuated by a repeating type counter, programs production of automotive muffler tube blanks in standard V & O inclinable press. Auxiliary counter controls blank cut-off. Varying perforation patterns are achieved with one set of tools. Integrating standard type mechanisms such as these to effect cost reduction illustrates the keen abilities that Emhart press experts can apply to your work improvement projects.

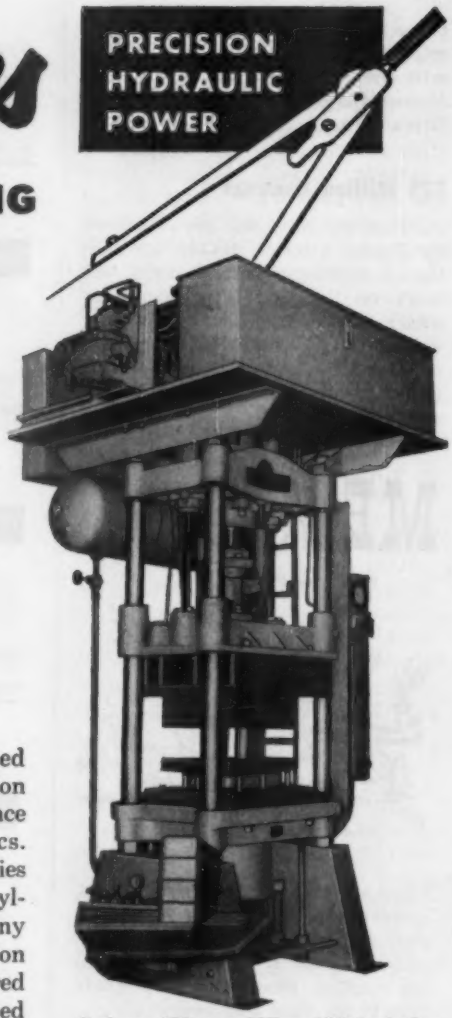
Emhart Manufacturing Co.
Hudson Div., Hudson, N.Y.
Formerly V & O Press Div.

EMHART

Rodgers Presses

FOR METAL FORMING and DRAWING

PRECISION HYDRAULIC POWER



Rodgers 100 ton 30" x 30" bed size with complete one cycle automatic control for deep drawing.

From Rodgers "Standard" Line Select your "Custom" Model

Easy as A B C:

A *Determine Press Tonnage and Style Press You Need*

B *Bed and Frame Size Required... Solid or Open Bolster*

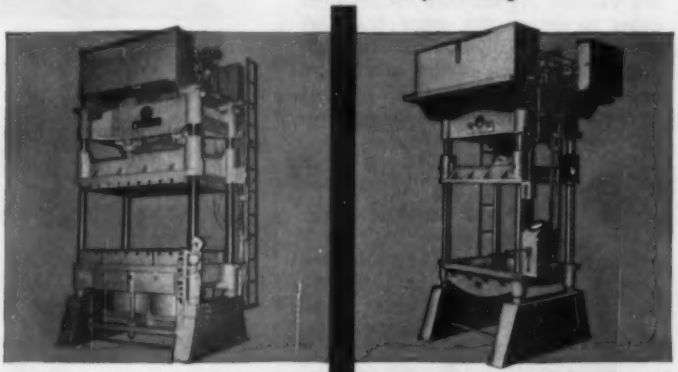
C *Select Pump Unit and Controls To Give Speed You Want*

The New Standard line of Rodgers Platen Presses has been designed to greatly simplify press selection. From the basic press styles, one may be selected and combined with varied pumps and controls, automatic, semi-automatic or pressure sensitive, to give the desired speed and performance. This results in savings of "custom" engineering and costs.

Rodgers Presses are designed and built by an organization with over 32 years' experience in high pressure hydraulics. They are available in capacities from 50 to 400 tons, single cylinder or twin cylinders, in many standard models for production or special uses. Where desired custom models will be designed to suit exacting special requirements.

SEND FOR *NEW* CATALOG 337...

This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion, 200 ton drawing press with 60" x 48" bed; single cycle automatic.

Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

HYDRAULICS Rodgers KEEP THE WORLD MOVING

RODGERS HYDRAULIC, Inc.

Pioneers in High Pressure Hydraulics Since 1932

7475 WALKER STREET • MINNEAPOLIS 26, MINNESOTA

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 RECIPROCATING TOOL GRINDERS—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* 4-page bulletin 465927 illustrates and describes two models, one for conventional grinding, the other for the electrolytic process. Both are double-end, dual-purpose machines for grinding cutting edges at one end and chip breaker grooves at the other. Specifications provided, accessories useful in sharpening tools discussed.

2 DEBURRING AND CHAMFERING GRINDER—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Technical bulletin DCG-1 covers new unit for spur, helical, and bevel gears. Machine simultaneously deburrs and chamfers the entire contour of both ends of gear teeth.

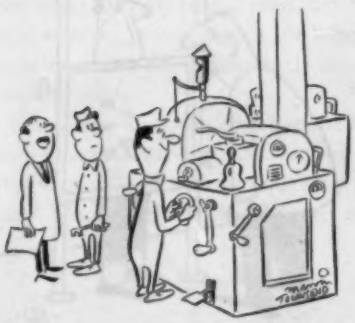
3 BAR AND ANGLE SHEAR—*Shearcase Co, PO Box 185, Torrance, Calif.* Literature pictures and gives information on 50-ton capacity unit designed with progressive shearing action of the blade when processing bar stock and angle iron. Features listed, standard and optional equipment covered.

4 PRECISION CHUCKING MACHINES—*Hardinge Brothers Inc, Elmira, NY.* Bulletin HC-HCT provides data on Models HC-cfr and HCT-cfr that enable operator to turn, face, bore, and thread in one chucking and one handling.

5 SMALL BORING MACHINES—*Excell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* 4-page bulletin 315925 describes and illustrates a single-end and a double-end model particularly suitable for boring small holes at close center distances. Various spindle setups are pictured as well as items of equipment that add to productivity and versatility.

6 DRY ABRASIVE CUTTING MACHINE—*Allison-Campbell Division, American Chain & Cable Co, Bridgeport 2, Conn.* 4-page bulletin DH-290 contains illustrated description of Model 2-A Sever-All for cutting solids, tubing, and structurals in steel, cast iron, and many nonferrous metals. Specifications and optional accessories included.

7 DRILLPRESS FEEDS — *Beckett-Harcum Co, 935 W Locust St, Wilmington, Ohio.* 8-page catalog F-60 covers line that consists of standard duty, heavy duty, and gear head air powered feeds, either mechanically or electrically controlled; and a hydraulic powered feed for



"He sure makes a big deal out of it when he makes the production quota."

feature by feature... the latest

LINLEY

JIG BORER

IS A TOP PERFORMER IN TODAY'S TOOLROOMS WHERE ACCURACY IS ESSENTIAL

1. Accurate to a high degree, the Linley is fast to set up and position and has the versatility required for precision tool work.
2. Ribbon type locks on both table and saddle for positive no-shift locking add to its dependability and lasting accuracy.
3. A tiller-type wheel facilitates final adjustment of the sliding head, raising and lowering it rapidly to exact degree desired.
4. A pin type lock for the spindle, speeds insertion and removal of tools and requires only one spanner wrench instead of two.
5. Feed screws on both table and saddle are an extra large size, ⅞" diameter, and heat treated for long wear with extreme accuracy.

Designed And Built For Precision Operation

The Linley Jig Borer is a precision machine designed specifically for small tool and die work and reasonably priced. It is available with many time saving accessories that add to its usefulness and speed.

We invite your inquiries; write for specifications, prices.

LINLEY BROTHERS CO.

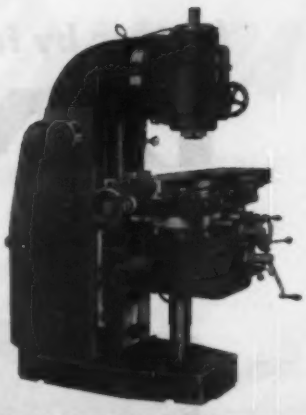
664 STATE ST. EXT. BRIDGEPORT 1, CONN.

POWER PERSONIFIED

SAJO No. 2 Vertical Miller

Just a glance at this rugged machine confirms its ability to perform with ease the most demanding jobs. Sajo's swivelling head, power feed to quill and unrivaled spindle construction combine versatility with unsurpassed tool room accuracy.

Also available —
Horizontal Millers
Plain and Universal



No. 2 Vertical Miller
table size: 52" x 11"
7½ and 1½ HP motors
rapid power traverse

austin industrial corporation

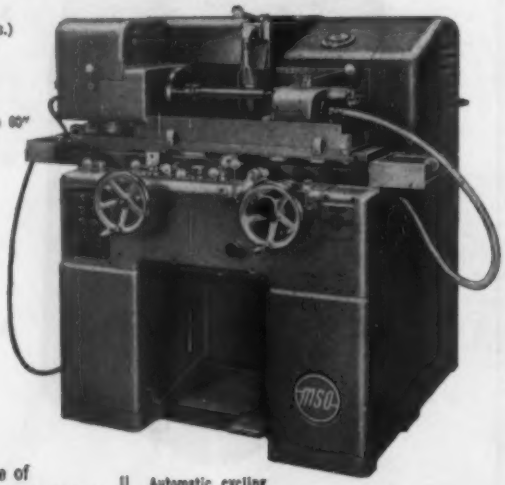
76-F Mamaroneck Avenue White Plains, New York

MSO
Since 1865

FOR MORE PROFITABLE GRINDING

For automatic production in plunge or traverse grinding MSO Hydraulic Grinders offer ease and speed of operation with single lever control, automatic cycling including variable spark-out to fine finish and preset size — against positive stop (repeat accuracy .00004") or by electric gauge.

Model FH-200 (Illus.)
Swing 10"
Model FH-100
Swing 7"
Model FH-300
Swing 13¾"
Grinding lengths to 60"



MSO offers
a complete line of
precision grinding machines
with features such as:

Automatic cycling
+ Precimatic sizing
+ Electronic Match Grinding

WRITE FOR LITERATURE ASK FOR REFERENCES

When only the best will do, check MSO first

austin industrial corporation

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Free Literature

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automating larger and heavier types of drilling machines. Catalog also gives data on air powered drilling and tapping machines.

TOOLS AND ACCESSORIES

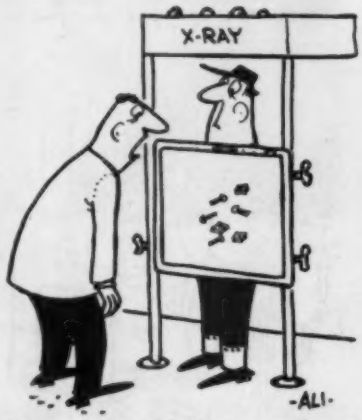
● "SHEFFIELD PRECISIONAIRE GAGING"—*Sheffield Corp, Box 893, Dayton 1, Ohio.* 50-page handbook (publication SPG-160) is a comprehensive manual on dimensional air gaging. Describes in non-technical language how to select the right amplification for the job, when to use long-range air gages, advantages and principles of air gaging IDs, ODs, and other geometrical conditions, and many other facets of dimensional control. Lists large variety of standard adjustable and special tooling and gaging fixtures that are used with column-type instruments. Request direct on company letterhead.

8 QUILLS—*Bryant Chucking Grinder Co, Springfield, Vt.* 15-page Form S-3 lists all quills available for Bryant grinding spindles. Detailed instructions for ordering the proper quill for each spindle are included as well as complete information on wheel binder screws and special wrenches.

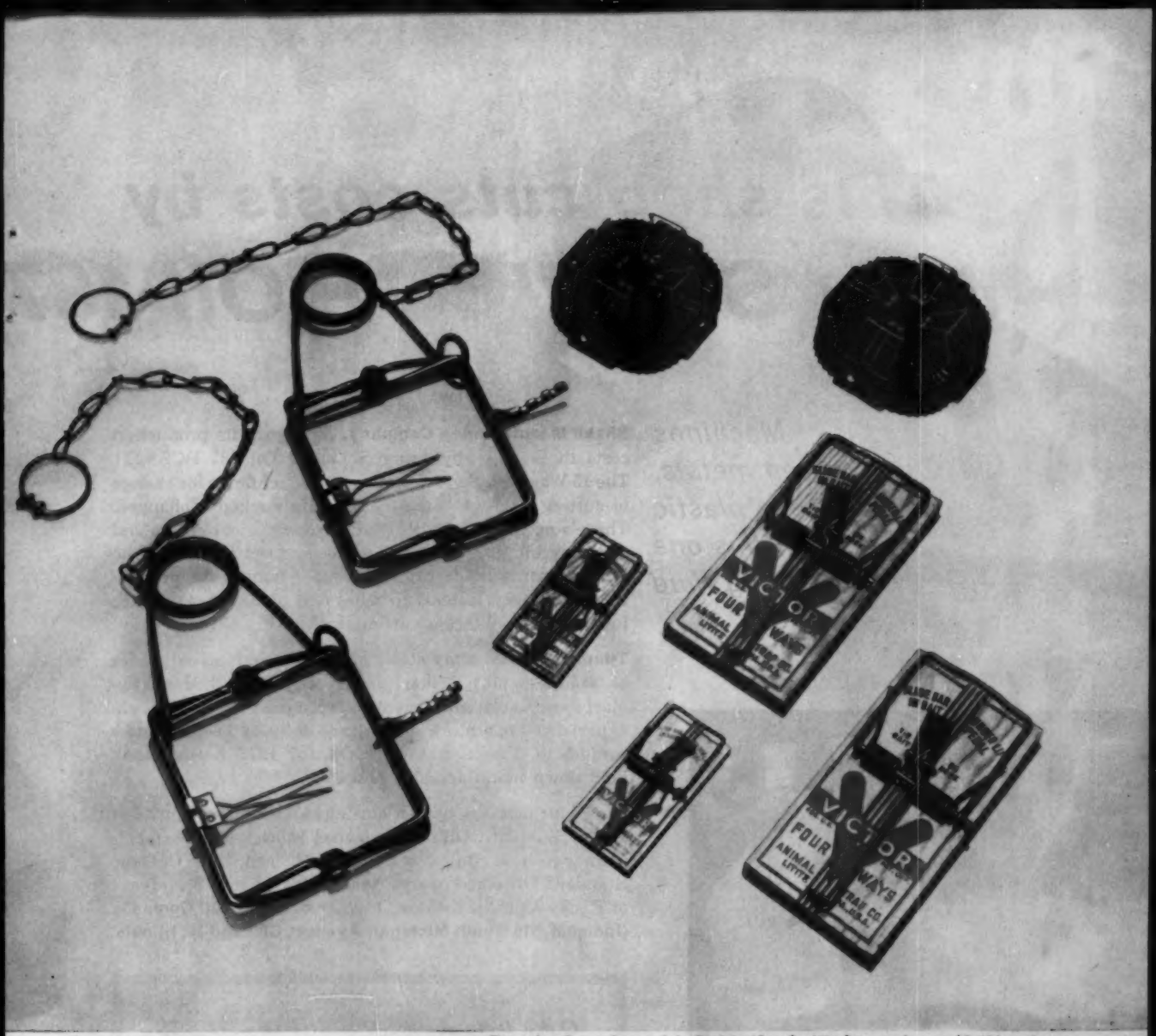
9 OPTICAL BENCHES — *Gaertner Scientific Corp, 1201 Wrightwood Ave, Chicago 14, Ill.* 28-page bulletin 156-59 describes complete line of optical and instrument benches. Gives general features, descriptions, and specifications for lathe bed type benches, double rod benches, single rod benches, and accessories.

10 THREAD GAGING—*Johnson Gage Co, Bloomfield, Conn.* 18-page catalog BC-1-60 presents illustrated descriptions of complete line of Ring-Snap, Roll-Snap comparators. Contains much essential technical information, including recommended gaging procedures, and screw thread gaging terminology.

11 CARBIDE TOOLS—*Greenfield Tap & Die Corp, Greenfield, Mass.* 32-page catalog provides detailed information on drills, reamers, end mills. Introduction for each section contains general data; standard sizes and dimensions tabulated. Technical data covers applications, resharpening, speeds and feeds, tolerances, specifications.



"Do you ever work with your mouth open in this nut and bolt factory?"



The products illustrated are made by The Animal Trap Co., Lititz, Pa., a regular user of Bethlehem wire.

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CIRCLE 294 READER SERVICE CARD

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This shop cuts costs by using STANICUT Oil 137

Machines seven metals, one plastic with this one cutting fluid

Shank Manufacturing Company, Chicago, cuts production costs three ways by using STANICUT Oil 137 BCS. (1) The 15 Warner & Swasey Lathes are never down for change of cutting fluid when the metal being worked is changed. There's no time lost with shutting down, cleaning up and changing oil. (2) There are no losses from the use of the wrong cutting fluid. (3) Floor space is used for productive machinery instead of being tied up as storage space for barrels of different cutting fluids.

Titanium, brass, alloy steel, aluminum and seven grades of Stainless plus Teflon plastic are all worked on the machines. Latest equipment, a reputation for good work, experienced operators and on-time delivery keep business coming to Shank. STANICUT Oil 137 BCS helps Shank hold down manufacturing costs.

Does cutting costs with a cutting fluid interest you? Let one of Standard Oil's experienced lubrication specialists show you how STANICUT Oil 137 BCS can do it. Call the Standard Oil office nearest you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

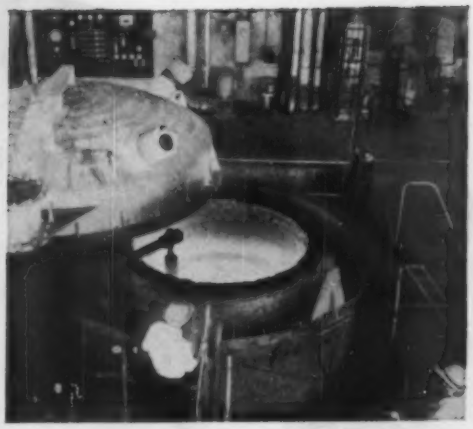
Commercially pure AMS 4921 Titanium oxygen injector nozzle gets an inspection from Frank Kruppe, Shank president (right), and Standard Oil's Henry Krueger. Hank Krueger provides Shank plant with technical service on cutting fluids and lubrication. Hank has the experience for this work. He's been doing it for six years. He has an engineering degree from Illinois Institute of Technology and has completed the Standard Oil Sales Engineering School course.

Quick facts about STANICUT OIL 137 BCS

- Has excellent extreme pressure properties. Ideal for low machinability steels.
- Has medium-low viscosity. Low enough for rapid, cooling flow. High enough to avoid "fogging".
- Non-corrosive to aluminum, *titanium* and all steels, tools and machines.
- Sterile, non-irritating and non-toxic.
- Suitable for many operations—tapping, threading, drilling, gear shaving, broaching, etc. Gives excellent tool life.

You expect more from STANDARD *and you get it!*

"Miking up" one of the pieces Shank produces, Frank Kruppe shows Hank Krueger quality of work turned out using STANICUT Oil 137 BCS.



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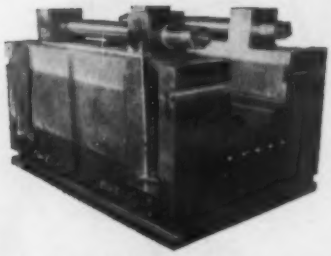

36,000 pound die holder for use in titanium production, completely machined by Finkl

DIE BLOCKS made with Finkl vacuum degassed EF steels have greater ductility and toughness. This means that the chances of breakage under severe operating conditions is reduced. More production time is made available. With about 50% of the non-metallic inclusions removed from the steel, machineability is improved. Fewer tool regrinds are necessary. Higher lusters are obtainable in the impressions.

We supply 5 types of pre-hardened, ready-to-use die blocks, inserts and hot work tools in Special Machining Quality steel.

FORGINGS by Finkl are famous for their strength and resistance to withstand the severe stresses and strains imposed by modern heavy-duty machinery. Now available on request are Finkl vacuum degassed EF alloy steel forgings. The degassed steel adds even greater toughness and ductility to the forging, and the cleaner steel substantially increases tool life.

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FORGE REPAIR PARTS with the advantages of Finkl vacuum degassed EF alloy steels are also available on request.

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◄ CIRCLE 296 READER SERVICE CARD

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To order any of these bulletins, circle corresponding number inside back cover.

12 INSPECTION TOOLS—*L S Starrett Co, Athol, Mass.* 48-page catalog illustrates and describes 88 tools including steel tapes; master vernier height gages and calipers; micrometer calipers, inside micrometers, micrometer depth gages and micrometer heads; combination sets, protractors, dividers, and trammels; dial-master indicators and dial bore gages; mechanics' tool chests.

13 GAGES—*Beloit Tool Corp, Regal Division, Beloit, Wis.* 24-page catalog and manual covers plug and ring gages, standard and special, both thread and plain gages. Charts give tap recommendations for classes of threads and screw thread standards.

14 THREAD MILLING CUTTERS AND GEAR HOBS—*Hanson-Whitney Co, Hartford, Conn.* Catalog and price list on multiple thread milling cutters and fine pitch gear hobs give selection and ordering information; includes catalog numbers for each stock size.

15 CONVERSION CALCULATOR — *Aluminum Co of America, 1501 Alcoa Bldg, Pittsburgh 19, Pa.* 2¼ x 13-in. calculator aids in determining total costs and savings in switching from brass to aluminum screw machine stock. The calculating instrument performs in minutes all major mathematical computations necessary to find cost ratios of a stock size of the two metals. Automatic allowance is made for operating scrap, bar end loss, and cutoff and facing losses.

16 TOOLHOLDERS FOR CARBIDE INSERTS—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 32-page illustrated booklet T-160 describes three lines; specifications, applications, ordering and dimension data included for each series.

17 VISES—*Chicago Tool & Engineering Co, 8392 S Chicago Ave, Chicago 17, Ill.* 19-page catalog (form 3547) pictures and gives information on Palmgren products including drillpress vises; angle vises; machine, air, and utility vises; heavy duty angle vises. Data also on rotary and indexing tables; adjustable angle plates; cross-slide milling tables; and milling attachments.

18 FLEXIBLE SHAFTING EQUIPMENT—*Jarvis Corp, Middletown, Conn.* 34-page brochure covers flexible shafting, flexible shaft machines, handpieces and accessories. Describes light and heavy duty machinery; floor, bench, overhead trolley, and portable wheel types.

"What do you mean you like it? That's what I use to clean the machines!"

CIRCLE 297 READER SERVCE CARD

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New Cooltex keeps machines cleaner, lets dirt and grit settle out faster. This means *freer, cooler grinding—without heat checks*—for smoother finishes. With Cooltex, wheels last longer, and you can even use a finer grit! Your Texaco Lube Engineer is sending out Cooltex reminder postcards. Watch for yours. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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19 TOOLS—*Lassy Tool Co, Plainville, Conn.* 11-page 1960 catalog describes devices for production, inspection, toolroom. Illustrates applications of the multipurpose work holder, available in three models; three models of hand tappers and accessories; a universal tap and die guide for drillpress and lathe tapping and threading; master angle plate available in two sizes and six models.

HEAT TREATING AND WELDING

20 INDUCTION HEATING UNIT — *C I Hayes Inc, 314 Wellington Ave, Cranston, RI.* Bulletin 5910 contains information on new high frequency generator induction heater unit for use principally in high speed selective hardening, tempering, and annealing of metal parts; also adaptable to many other heating and bonding applications. Covers applications, specifications, components, safety and control equipment.

21 RESISTANCE WELDING DATA— *Ampco Metal Inc, Box 2004, Milwaukee 1, Wis.* 20½ x 29½-in. wall chart (RW-5) includes RWMA specifications for spotwelding similar and dissimilar metals; projection welding data; conversion data on commonly welded metals; spotwelding and seamwelding schedules for low-carbon steel. Also gives data pertaining to heat balance; secondary amperes and electrical force; and average properties of high conductivity alloys.

22 HOT PLATE—*Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill.* Pamphlet illustrates and describes 1960 Model Pyrodisc portable electric hot plate for use in industrial laboratories with limited volume of hot plate work. Also contains information on standard line of heavy duty hot plates for general heating, boiling, and evaporations.

23 WELDING UNITS—*National Cylinder Gas Division, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill.* Illustrated brochure NH-179 gives data on four models of Sureweld gasoline engine-powered units which provide dc or ac/dc welding current for jobs beyond the power line. Dimensions and specifications, welding range, rated output, maximum voltage, and auxiliary power specifications listed for each.

"I guess we better try again tomorrow — I just saw him taking two aspirin—"

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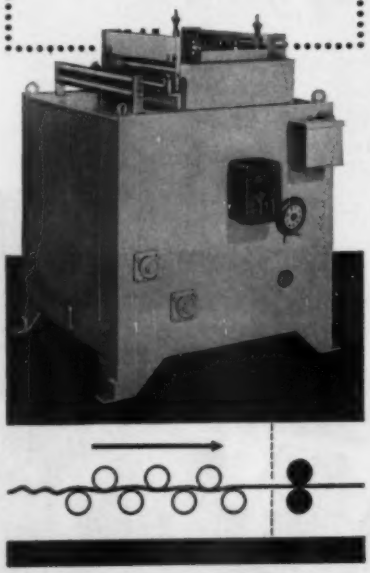
benchmaster

Combination Feeding and Straightening Machine



Feeds measured lengths of coiled, strip or flat stock to presses, shears and other machines. Simultaneously removes kinks, moderate curl, camber, etc., with 9 adjustable power-driven rolls. Equipped with electro-magnetic clutch drive and adjustable timer for delivering measured feed lengths.

TWO MODELS: Single clutch for nominal feed accuracy or double clutch for increased feed accuracy. Standard feed range 0-60". Alternate ranges on request. Special timer bypass extends range to any length required. Models available for material to 50" wide, various gauges. Larger sizes are available on special order.

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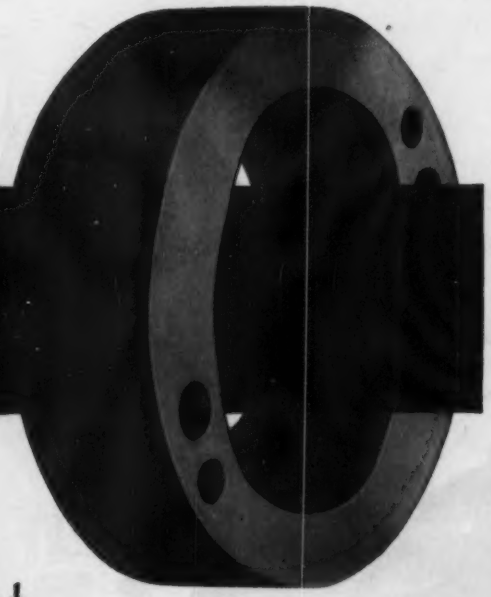
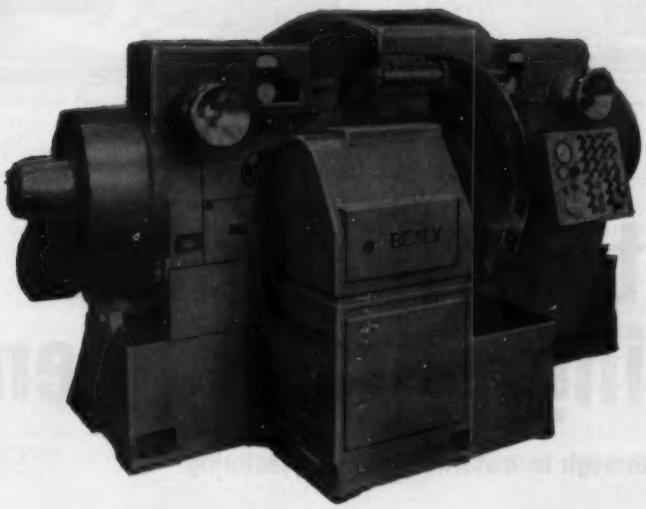


A dense cast alloy PUMP RING, 2½" dia. x ⅞", finish-ground at 300 per hour by a BESLY DH4 grinder. It gaged out to ±.0001" and .000050" for flatness and parallelism. Stock removed was .0015". The ground faces checked out at 12 micro-inch finish.

If your grinding equipment can't turn out such results...**Better see Besly!**



BESLY DH4 double horizontal spindle disc grinder. Has *exclusive* precision quill and clutch infeed that provides feed increments calibrated in *millionths*. Abrasive discs can be changed in 30 minutes without disturbing setup, *cutting downtime in half*. Dressing time is only four minutes, *1/5 the usual time!* Simplified push-button operation and controls, built-in dials, gages and meters to indicate abrasive conditions, movement and alignment, motor load, etc., assure precise results, dependable grinding production.

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A metalworking manufacturing report for advertisers

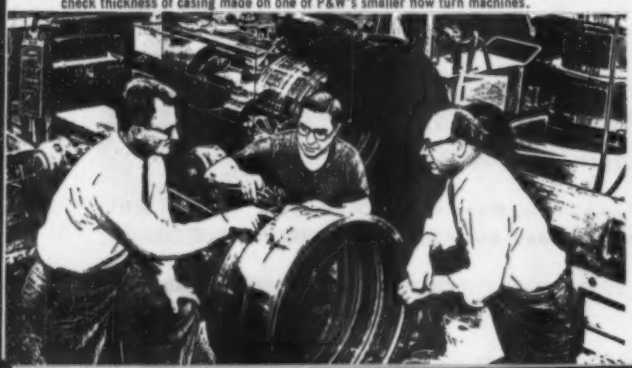
Design huddle produces ideas for machine which "flows" a metal ring into a seamless compressor case. Standing, l. to r.—L. J. Dolin, superintendent, experimental sheet metal; Robert Knowlton,

Lighter, stronger, faster jet engines... constant challenge for

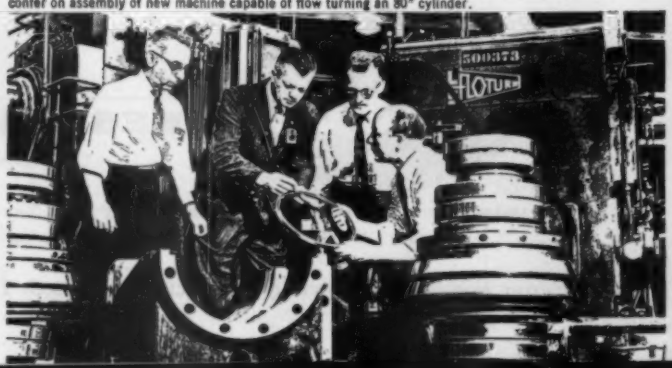
Pratt & Whitney Aircraft's manufacturing miracle men

Management team pioneers major breakthrough in metalworking manufacturing

Check-up—Bob Knowlton (l.), Stan Rusczik (r.) and operator Dominick Casasanta double check thickness of casing made on one of P&W's smaller flow turn machines.



New horizons—Production Engineer Edward Griswold, Bob Knowlton, Stan Rusczik and Lou Dolin confer on assembly of new machine capable of flow turning an 80" cylinder.



supervisor, advanced tool engineering; Stanley Rusczik, production engineer; and Robert C. Wright, chief, production engineering, for P & W—and, front, Claus L. Sporck, V.P., Lodge & Shipley Co.

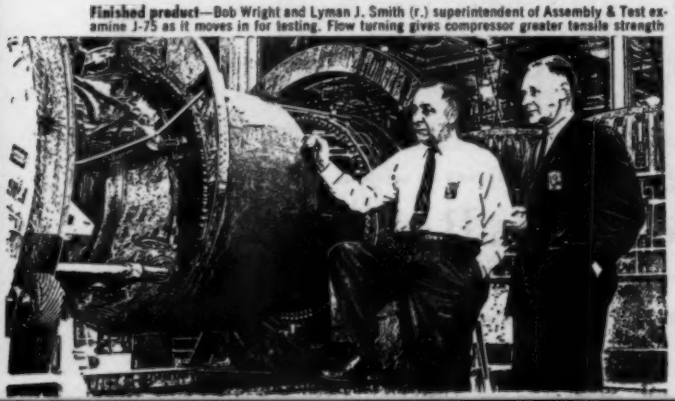
The difference between a 2-oz. jigger and a combustion chamber case for a 25,000-pound-thrust class J-75 jet engine is years of planning, imagination, engineering—and purest optimism. But it's typical of the manufacturing miracles that Pratt & Whitney Aircraft brings off as a matter of course.

The power plants for jet transports which now fly the Atlantic in 6½ hours are lighter, faster and stronger because a Norwegian engineer placed a 2-oz. jigger on the desk of the chief of advanced tool engineering at P&WA. The piece was unusual: seamless, even-walled, lightweight, finely-finished, and made on a machine that literally "flowed" a metal ring into cylindrical or conical shapes.

Here was an idea—if only it could be done on a large-enough scale. P&WA manufacturing men decided to give it a try. They teamed up with machine tool manufacturers Lodge & Shipley to produce the first flow turning machines in the U.S.—and the giants that are now turning out compressor cases and other highly stressed parts for P&WA jet engines.

The story of flow turning (*or shear forming as it is sometimes called*) has been told in detail in American Machinist/Metalworking Manufacturing. It's a story of the constant search for better ways to make things of metal. Our job is to keep manufacturing management men in metalworking posted on developments that will help solve manufacturing problems. More than 41,000 of them turn to AM/MM for just that kind of help. Here, then, is the ideal place to show how *your* product can help them!

Finished product—Bob Wright and Lyman J. Smith (r.) superintendent of Assembly & Test examine J-75 as it moves in for testing. Flow turning gives compressor greater tensile strength



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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 14

Subject: Class 5 Interference-Fit Thread

This class thread provides by flank engagement, a metal-to-metal fit of an oversize external thread in a standard tapped hole, resulting in plastic flow of metal. So many variables are involved in this type of fit that only until recently has it been possible to set up standards which will satisfy the requirements. Most users have found it necessary to use some version of the principle of "selection" and "fitting" for at least a portion of their products.

Interference-fits have for many years been synonymous with trouble. Based on a recently discovered principle of thread action, the new Class 5 thread dimensions listed in the tables below, together with the other design and application data in ASA-B1. 12 published by The American Society of Mechanical Engineers, offers new hope to users of interference-fit studs, bolts and screws.

External Thread Dimensions for Class 5 Standard*

Size	Major Diameter†						Pitch Diameter † Design Form		Minor Diameter†
	NCSHF for driving in ferrous material with hardness greater than 160 Bhn $L_e = 1\frac{1}{4}$ Diam		NCSCSF for driving in brass and ferrous material with hardness equal to or less than 160 Bhn $L_e = 1\frac{1}{4}$ Diam		NCSONF for driving in nonferrous except brass (any hardness) $L_e = 2\frac{1}{2}$ Diam				
	Max	Min	Max	Min	Max	Min	Max	Min	Max
1/4 - 20	0.2470	0.2408	0.2470	0.2408	0.2470	0.2408	0.2230	0.2204	0.1932
5/16 - 18	0.3080	0.3020	0.3090	0.3030	0.3090	0.3030	0.2829	0.2799	0.2508
3/8 - 16	0.3690	0.3626	0.3710	0.3646	0.3710	0.3646	0.3414	0.3382	0.3053
7/16 - 14	0.4305	0.4233	0.4330	0.4258	0.4330	0.4258	0.3991	0.3955	0.3579
1/2 - 13	0.4920	0.4846	0.4950	0.4876	0.4950	0.4876	0.4584	0.4547	0.4160
9/16 - 12	0.5540	0.5460	0.5580	0.5495	0.5580	0.5495	0.5176	0.5136	0.4695
5/8 - 11	0.6140	0.6056	0.6195	0.6111	0.6195	0.6111	0.5758	0.5716	0.5235
3/4 - 10	0.7360	0.7270	0.7440	0.7350	0.7440	0.7350	0.6955	0.6910	0.6378
7/8 - 9	0.8600	0.8502	0.8685	0.8587	0.8685	0.8587	0.8144	0.8095	0.7503
1 - 8	0.9835	0.9727	0.9935	0.9827	0.9935	0.9827	0.9316	0.9262	0.8594
1 1/8 - 7	1.1070	1.0952	1.1180	1.1062	1.1180	1.1062	1.0465	1.0406	0.9640
1 1/4 - 7	1.232	1.220	1.2430	1.2312	1.2430	1.2312	1.1715	1.1656	1.0890
1 3/8 - 6	1.356	1.341	1.3680	1.3538	1.3680	1.3538	1.2839	1.2768	1.1877
1 1/2 - 6	1.481	1.467	1.4930	1.4788	1.4930	1.4788	1.4089	1.4018	1.3127

*The tables are based on externally threaded members being steel ASTM A-325 (SAE Grade 5) or better. See Table 1.
†All dimensions are in inches. For rolled, cut or ground threads. For definition of thread elements see ASA B1.1, current edition.

Internal Thread Dimensions for Class 5 Standard

Size	NCSIF Ferrous Material			NCSINF Nonferrous Material			Pitch Diameter		Major Diam
	Minor Diam		Tap Drill	Minor Diam		Tap Drill			
	Min	Max		Min	Max		Min	Max	Min
1/4 - 20	0.196	0.206	13/64	0.196	0.206	13/64	0.2175	0.2201	0.2500
5/16 - 18	0.252	0.265	G	0.252	0.265	G	0.2764	0.2794	0.3125
3/8 - 16	0.307	0.321	O	0.307	0.321	O	0.3344	0.3376	0.3750
7/16 - 14	0.374	0.381	3/8	0.360	0.372	U	0.3911	0.3947	0.4375
1/2 - 13	0.431	0.440	11.0mm or 0.4330	0.417	0.429	27/64	0.4500	0.4537	0.5000
9/16 - 12	0.488	0.497	12.5mm	0.472	0.485	31/64	0.5084	0.5124	0.5625
5/8 - 11	0.544	0.554	35/64	0.527	0.540	17/32	0.5660	0.5702	0.6250
3/4 - 10	0.661	0.678	43/64	0.642	0.655	16.5mm	0.6850	0.6895	0.7500
7/8 - 9	0.777	0.789	25/32	0.755	0.770	49/64	0.8028	0.8077	0.8750
1 - 8	0.890	0.904	57/64	0.865	0.880	7/8	0.9188	0.9242	1.0000
1 1/8 - 7	1.000	1.015	1	0.970	0.991	63/64	1.0322	1.0381	1.1250
1 1/4 - 7	1.125	1.140	1 1/8	1.095	1.115	1 7/64	1.1572	1.1631	1.2500
1 3/8 - 6	1.229	1.247	1 15/64	1.195	1.213	1 13/64	1.2667	1.2738	1.3750
1 1/2 - 6	1.354	1.372	1 23/64	1.320	1.338	1 21/64	1.3917	1.3988	1.5000

All dimensions are in inches, unless otherwise specified. For definition of thread elements see ASA B1.1, current edition.

"Extracted from Trial American Standard Class 5 Interference-Fit Thread (ASA B1.12), with the permission of the publisher, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y."

• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.
22 Mann Street, Worcester, Mass.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

PLANT SERVICE EQUIPMENT

24 DUST CONTROL—*Dracco Division, Fuller Co, Harvard Ave & East 116th St, Cleveland 5, Ohio.* 28-page bulletin 805 describes complete range of dry collection equipment. Includes information and specifications on the Multi-Bag Filter, Uni-Filter, Glass-Bag Filter, and Whirl-Clone, plus special collectors and accessories.

25 SHOT AND GRIT ABRASIVES—*National Abrasive Co, 3560 Norton Rd, Cleveland 11, Ohio.* 30-page illustrated booklet covers use in blast cleaning. Discusses blast cleaning functions and materials, considerations of shot and grit size, consumption, maintenance costs, time and finish factors. Describes new products, materials, standards, specifications. Includes chart-illustrated methods of computing costs of new and improved abrasive products against existing or former materials.

26 "CURRENT USES FOR ELECTROFORMING" — *Allied Research & Engineering Division, Allied Record Manufacturing Co, 6916 Santa Monica Blvd, Los Angeles 38, Calif.* Illustrated 32-page technical handbook incorporates latest data on electroforming. Includes chapters on what the process is, where it is used, do's and don'ts for designers, and charts and tables of engineering data.

● PROTECTIVE COATINGS—*Master Bronze Powder Co, 538 W State St, Calumet City, Ill.* 16-page catalog covers Derusto protective coatings, Galv-a-grip, Derusto Colored Aluminum, Minit-Finishes, and special Derusto Chemical Resistant and Hi-Heat rust inhibitive coating. Selector guide evaluates technical properties of various products. Applications discussed. Request direct on company letterhead.

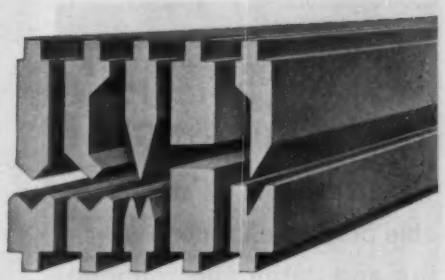
PARTS AND MATERIALS

27 BEARING UNITS—*Browning Manufacturing Co, Maysville, Ky.* 10-page catalog BU-103-A covers complete line including pillow blocks with sealed bearings; flange units; tapered roller bearing pillow blocks and flange blocks; take-up units. Includes load rating and comparison charts, detailed specifications.

28 TUBE FITTINGS—*Imperial Brass Manufacturing Co, 6300 W Howard St, Chicago 48, Ill.* 44-page catalog 3108 illustrates, describes, and provides technical data on complete Hi-Seal butt-joint fitting line. Contains over 250 additional

"I wanna see my union representative!"

press brake tooling



Standard Type PRESS BRAKE DIES

62 different sizes and styles • Most in stock for off-the-shelf delivery

CHICAGO standard type press brake dies are used for a large variety of bending operations in any make or size of standard press brake. They are economical, and the quick delivery saves time in tooling up. Available in any length from 4 to 12 feet in increments of 2 feet; *induction hardened* or Diekrome steel.

The local distributors listed below offer immediate delivery on many sizes and styles of standard type CHICAGO press brake dies. If you have Bulletin STD-959 you can order any standard type die by number. Why not ask your nearest distributor for a copy? Also, if your requirements call for special multibend and forming dies, he can tell you about Dreis & Krump complete tooling service for any make of press brake.

Call your nearest distributor

ALABAMA
Birmingham
Hinkle Supply Co., Inc.
FAirfax 2-4541

CALIFORNIA
Los Angeles
Meyer Sheet Metal Mchry. Co.
VAn Dyke 1477
San Francisco
Harron, Rickard & McCone Co.
ATwater 2-2202

GEORGIA
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Allison Mchry. Co.
JAckson 4-1741

INDIANA
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E. L. Humston Co., Inc.
WAlnut 5-9691

IOWA
Bonaparte
Corry's Machine & Tool—Phone: 112

KANSAS
Wichita
Elifeldt Mchry. & Supply Co.
AMherst 7-9773

MASSACHUSETTS
Cambridge
Austin-Hastings Co., Inc.
Kirkland 7-4480

MICHIGAN
Detroit
J. Lee Hackett Co.—TRinity 2-6442

MINNESOTA
Duluth
Girard Steel Supply Co.
MArket 8-1001
Minneapolis
Minnesota Steel & Mchry. Co.
FEderal 3-6273
St. Paul
Girard Steel Supply Co.
Midway 6-9635

MISSOURI
Kansas City
Elifeldt Mchry. & Supply. Co.
Victor 2-5494

NEW YORK
New York
Federal Machinery Corp.
CAnal 6-3022
H. Weiss & Co.
CAnal 6-4256

NORTH CAROLINA
Greensboro
Armentrout Mchry. Co.
Phone: 4-8218

OHIO
Cleveland
Wm. K. Stamets Co.
MAin 1-5124
Columbus
Vorys Brothers, Inc.
AXminster 4-4701

OKLAHOMA
Oklahoma City
Hart Industrial Supply Co.
REgent 9-2541
Tulsa
Hart Industrial Supply Co.
LUther 3-2175

OREGON
Portland
Pacific Metal Co.
CApitol 7-0693

PENNSYLVANIA
Philadelphia
Delaware Valley Mchry., Inc.
OLdfield 9-4600
Milton Equipment Co.
WAlnut 2-1734
Pittsburgh
Wm. K. Stamets Co.
ATlantic 1-8091

TEXAS
Dallas
Briggs-Weaver Mchry. Co.
LAkeside 8-0311
Fort Worth
Briggs-Weaver Mchry. Co.
EDison 6-5621
Houston
Mehl Machinery, Inc.
FAirfax 3-1313

WASHINGTON
Seattle
Pacific Metal Co.—MAin 6925

WISCONSIN
Milwaukee
Production Equipment, Inc.
GReenfield 6-6075

CANADA
A. R. Williams Mchry. Co., Ltd.

ALBERTA
Calgary—Phone: 5-4425
Edmonton—Phone: 24341

BRITISH COLUMBIA
Vancouver—TAtlow 9411
Victoria—Phone: 4-7623

MANITOBA
Winnipeg—SPruce 4-4458

NOVA SCOTIA
Halifax—Phone: 5-4389

ONTARIO
Hamilton—JAckson 9-5388
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QUEBEC
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0202

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Press Brakes • Press Brake Dies
Straight-Side-Type Presses
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CHICAGO DREIS & KRUMP

DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

(Advertisement)

DYNAMIC POLISHING AND DEBURRING

The GRIND-O-FLEX saves valuable production time in polishing and deburring rounded, contoured and flat surfaces. A flexible abrasive wheel that features **SLASHED** construction, type BL GRIND-O-FLEX practically envelopes the part with dynamic, moving abrasive.

Easy to use, economical, the GRIND-O-FLEX consists of a rugged hub that holds a number of simple-to-replace abrasive pads. No special tools are required to load the hub.

The pads, available in a variety of grits, wear evenly, exposing a continuously fresh abrasive surface.

Write today!..for illustrated technical bulletin and price list.

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Free Literature

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styles and sizes; gives information on Braze-Seal fittings for extra high pressure and temperature.

29 CYLINDERS — *Flick-Reedy Corp, York and Thorndale Rds, Bensenville, Ill.* 24-page bulletin P2547P describes products of both the Miller Fluid Power and Tru-Seal Divisions. Covers air and hydraulic cylinders, non-sag piston rods, high-speed cushions, adjustable stroke cylinders, air-hydraulic boosters, air-oil circuits, and Tru-Seal pipe thread fittings for eliminating positioning problems and leakage at threaded connections. Includes simplified mounting and dimensional data and thrust charts for quick selection of bore sizes.

30 "METALS FOR PRECISION AND PERFORMANCE" — *J Bishop & Co, Malvern, Pa.* 24-page brochure contains 20-page section devoted to the end uses of Bishop small diameter tubing. 4-page section covers platinum and other precious metal products used alone and in combination with other metals.

31 ALUMINUM BRONZE ALLOYS—*Ampco Metal Inc, Box 2985, Milwaukee 1, Wis.* 20-page bulletin 33e gives chemical and physical properties of a series of special alloys. Nine major grades and heat-treated variations of Ampco Metal are described; closely controlled chemical limits are shown and recommended applications for each grade are listed. Non-magnetic, non-sparking material possesses high resistance to metal-to-metal wear, abrasion, fatigue, and corrosion.

● "PRECISION INSTRUMENT COMPONENTS STANDARD BOOK" — *PIC Design Corp, 477 Atlantic Ave, East Rockaway, LI, NY.* 400-page (loose-leaf) manual contains modification drawings, prints, specifications, purchasing drawings and similar material on reproducible tracing paper 8½ x 11 in. Request direct on company letterhead.

32 FABRICATED SILICONE RUBBER—*Haveg Industries Inc, Taunton Division, 386 Weir St, Taunton, Mass.* 6-page bulletin HTM-2-1-60 illustrates and describes custom engineered seals for the aircraft, electronic, and appliance industries; precision molded parts; extruded parts; and sheet and die cuts available.

33 PNEUMATICALLY OPERATED COMPONENTS—*Airelectric Corp, PO Box 208, Melrose Park, Ill.* 4-page illustrated circular describes new line of poppet operating valves for Airelectric Airswitch 4-way bled-operated 2-way air valves.

34 FASTENER FATIGUE CONTROL—*Elastic Stop Nut Corp of America, 2330 Vauxhall Rd, Union, NJ.* 32-page Design Manual 5930 illustrates the ESNA developed Equa-Stress modified UNF-3 thread form which, installed in a new series of Elastic Stop nuts, will reportedly at least double the fatigue endurance of a standard high tensile bolt. Includes 17 pages of findings related to the basic nature and causes of fastener fatigue; six detailed drawings of the new Double/Durability self-locking nuts; and applicable fatigue performance test results.

35 GENERAL PURPOSE MOTORS—*General Electric Co, Schenectady 5, NY.* 12-page bulletin GEA-6424A discusses benefits and features of complete line of fractional horsepower Form G units. Capacitor-start, split-phase, permanent-split capacitor, shaded-pole, and polyphase motors included. Sixteen different kinds of motors ranging from units for machine tools to room air-conditioner models are covered in NEMA frame sizes 48 through 56.

36 "ALCOA IMPACTS—METAL IN MOTION"—*Aluminum Co of America, 734 Alcoa Bldg, Pittsburgh 19, Pa.* 34-page booklet provides information on latest developments in the impact process (impact extrusion). Twelve main sections outline design possibilities, tolerances, size ranges, and applications of impacts. Alcoa's impact press and secondary facilities are detailed.

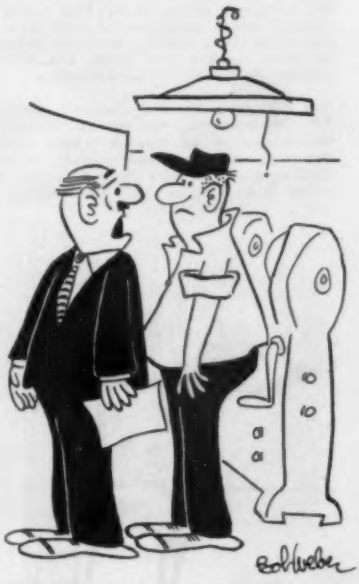
37 ELECTRIC CONTROLS — *Warner Electric Brake & Clutch Co, P-75, Beloit, Wis.* 8-page booklet describes line of standard, special, and custom controls used to actuate Warner electric brakes and clutches. Operation, dimensions, selection data included.

38 ALUMINUM MILL PRODUCTS—*Kaiser Aluminum & Chemical Sales Inc, 300 Lakeside Drive, Oakland 12, Calif.* 24-page manual explores characteristics of aluminum and types of alloys. Tables and photos give information on wrought alloys, including sheet, plate, foil, rod, bar and wire, and extrusions. Properties of casting alloys listed; all types of forgings pictured and described.

39 ELECTRIC MOTORS—*B & B Electric Motor Co, 206 Lafayette St, New York 12, NY.* 28-page catalog 108-60 lists hundreds of geared and non-geared units from 1/2000 to 25 hp with speeds from 0.65 to 10,000 rpm. Electrical information and prices included.

40 HIGH-TEMP MATERIAL — *Carborundum Co, Buffalo Ave, Niagara Falls, NY.* 8-page brochure gives data on Fiberfrax Ceramic Fiber that withstands operating temperatures up to 2300 F. Includes properties, available forms, current uses and applications.

41 AIRCRAFT SPEC CHART — *Tube Distributors Co, 1339 Kellum Pl, Garden City, NY.* Comprehensive chart of aircraft tubing specifications, designed in the shape of a file folder, contains information on dozens of items including applications, physical and chemical properties. Includes list of 18 ways to save money in steel tubing purchases.



"Hilton, I'd like to commend you on the fine job you're doing for the company — when are you going to give me the chance?"

proven design features . . .

Here is the first in the all new, field tested line of heavy duty Nebel Lathes.

It is a versatile extension bed gap lathe, providing 26½" swing over the upper bed, 46" swing through the gap and 48" to 84" distance between centers in the base length.

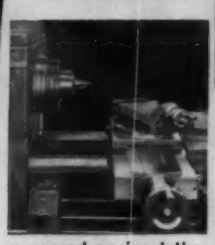
It is built to complete A.S.A. standards and tolerances of accuracy for engine lathes, still maintaining Nebel economy.

- Heavy duty 3-bearing spindle with zero precision bearings.
- 18 spindle speeds through complete gear range . . . up to 1500 RPM . . . streamlined speed selection.
- 60 different feeds . . . 60 thread changes, all directly read.
- Automatic lubrication.
- Wide design carriage with 146 square inches of bearing surface on bed ways.
- Double-wall one piece totally enclosed apron with simplified controls.
- End gearing totally enclosed in self-lubricating housing.
- Power traverse heavy duty tailstock with rugged thrust lock.
- Rigid box girth design of upper and lower bed . . . hardened and ground steel bedways on upper bed.
- Maximum diameter in gap faced in one setting of tool.

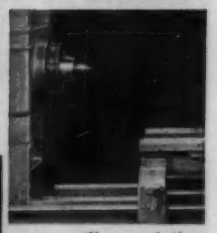
Write for new, fully descriptive Bulletin No. 211.

Nebel Lathe Division • Nebel Machine Tool Corp.
3407 Central Parkway, Cincinnati 25, Ohio

NEW



a rugged engine lathe

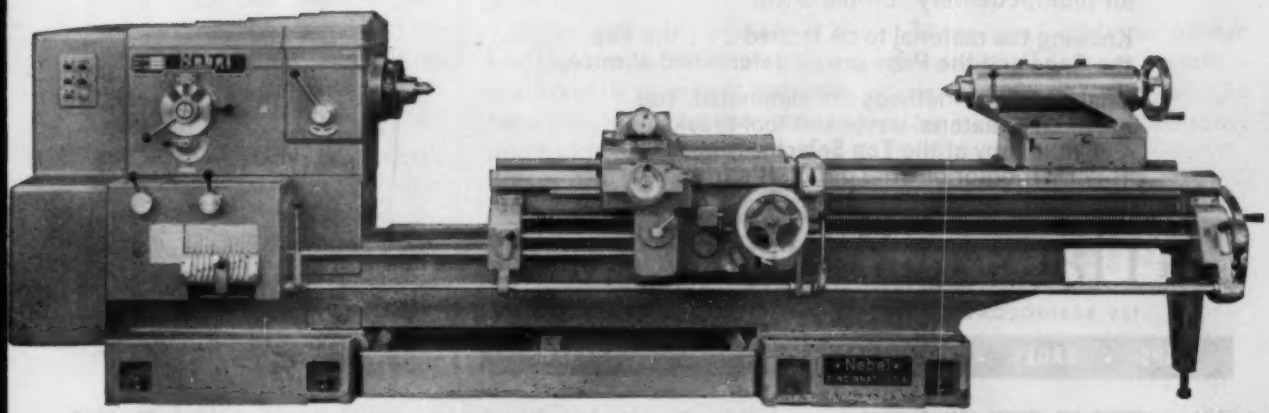


a versatile gap lathe

NēBEL

HEAVY DUTY DOUBLE PURPOSE LATHE

entirely new, proven design



NEBEL MODEL HXB 26/45 HEAVY DUTY EXTENSION BED GAP LATHE

CIRCLE 307 READER SERVICE CARD

For the first time you can easily select the **right** tap for the job. With the NEW Hanson-Whitney **Tap Selector**, you simply order from your Distributor by catalog number for prompt delivery "off-the-shelf."

Knowing the material to be tapped . . . the Tap, the Gage and the Price are all determined at once.

Trial and error methods are eliminated. You save time, material-waste and tool-breakage. Get your copy of the **Tap Selector** from your H-W Distributor or write direct. **It's free!**

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TAPS • GAGES • COMPARATORS • HOBS • CUTTERS

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

42 COPPER-CLAD LAMINATE—*Taylor Fibre Co, Norristown, Pa.* Technical data sheet No. 3.1.8.2 gives information on new hot-punch laminate with excellent punching and electrical characteristics, high surface resistivity and insulation resistance and low dielectric loss. Properties, and dimensional data both on thickness of the copper foil and on overall sheet size discussed.

43 POP RIVETS—*Pop Rivet Division, United Shoe Machinery Corp, Shelton, Conn.* 8-page illustrated catalog describes the two basic types, tells how to select proper one for specific application, provides ordering information. Includes illustrated listing of all tools available for job shop or high speed production operations.

44 FILTRATION EQUIPMENT — *Commercial Filters Corp, 2 Main St, Melrose, Mass.* 8-page catalog GEO-506A gives brief description of each of the products in the line which includes Fulflo, Delpark, Honan-Crane, and Michiana filters for continuous micro-clarity of all types of industrial fluids. Data on applications, operating pressures, and sizes; various types of filter media described and illustrated.

MISCELLANEOUS

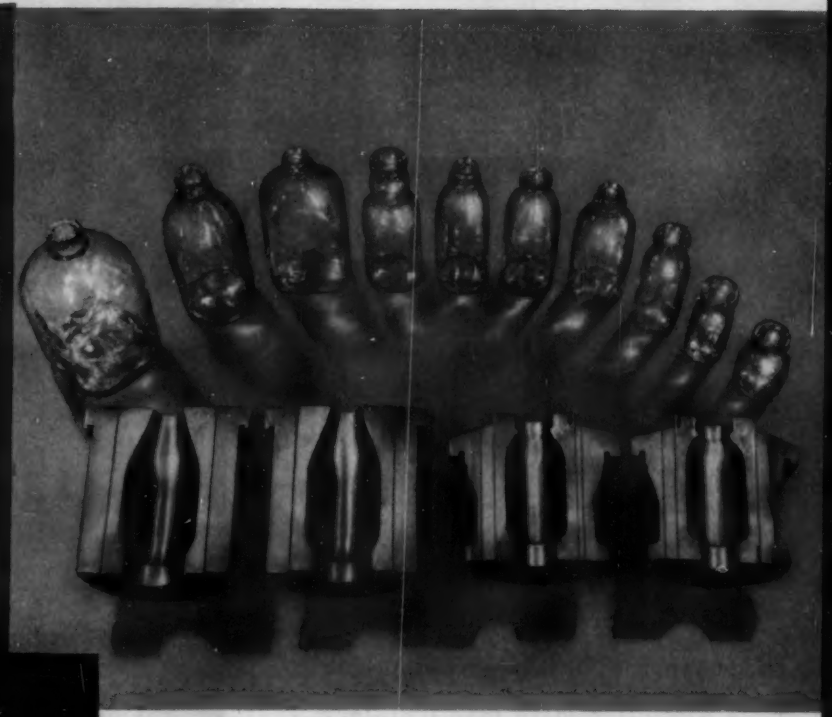
45 METALWORKING OPERATIONS—*Omaha Steel Works, 609 S 48th St, Omaha 6, Neb.* Packet of five brochures describes facilities and services of divisions of the company: foundry, heat treating, machine shop, fabrication, and manufacturing for contract work on hundreds of products or subassemblies, production of which requires diversified metalworking operations.

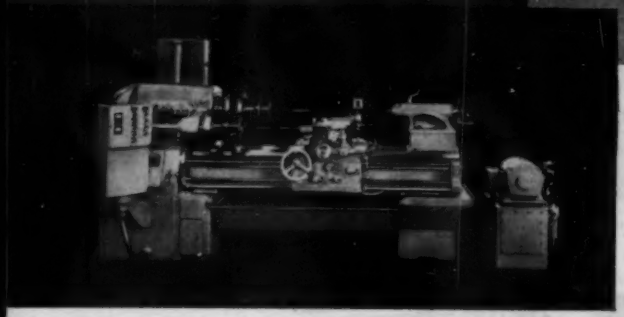
46 SALES AND USE TAX—*Machinery Dealers National Association, 1346 Connecticut Ave, NW, Washington 6, DC.* Recent study, available in chart form, lists the type of tax (sales or use) prevailing in each state (including Alaska and Hawaii); the rate in effect; and comments on particular situations, usually referring to exemptions. Sales taxes, and use or compensation taxes are explained in breakdown manner in preliminary data.

47 EQUIPMENT LEASING PLAN—*United States Leasing Corp, 530 California St, San Francisco, Calif.* 6-page brochure explains company's program of leasing diversified, non-expendable equipment and fixtures, including production and general office equipment. Outlines advantages of leasing and answers common questions on practice and procedure.

Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes

MONARCH'S SPECIAL-PURPOSE LATHES OF TOMORROW...





1..The New Rotary Profile Tracer Lathe for Non-Circular Cross-Section Work

Up to *three times* more productive than equipment now in common use! Hand finishing drastically reduced! This new Monarch says "Lower Costs" two ways—on circular or non-circular cross-section work, such as the bottle molds above.

It has speed and accuracy that's only been a dream till now. Featuring the new Monarch super-sensitive electro-hydraulic tracer, it delivers accuracy of duplication of ±.001" when the tool is traveling at a 100" per minute rate. At only a slight increase of error, tool travel up to 300" per minute is possible.

Stylus deflection pressure is a low 1½ ounces. Electrical amplification of its movement instantly translates work contour change into hydraulic slide movement.

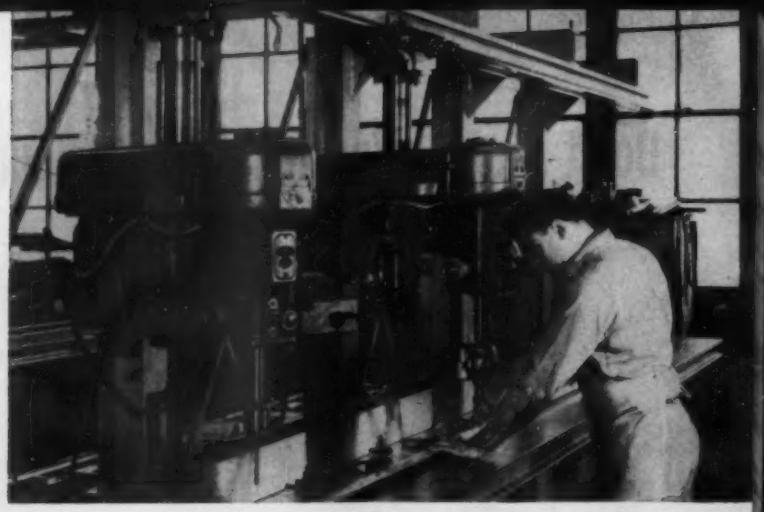
As you see, the master spindle is mounted at the front of the machine for ease of setup and operation. There's a positive gear drive from the headstock spindle through a quadrant-mounted idler which may be adjusted to eliminate any backlash between the lathe spindle and the master.

Want your costs to plunge downward? If that isn't worth a letter of inquiry—what is? *The Monarch Machine Tool Company*, Sidney, Ohio.

Monarch TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

3 WAYS you can use WT ALKER-TURNER



Rail mounted standard components

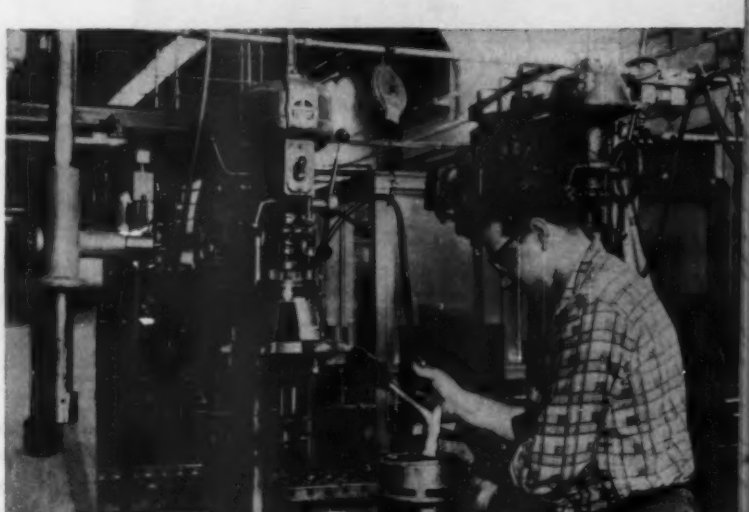
20″ drill presses to cut costs

Here are just three of the many ways you can save money using Walker-Turner "Light Heavyweight" 20″ drill presses for drilling and tapping operations. For standard applications or in special setups, you'll find that these fast, accurate, low-cost tools really pay off in performance. And they offer the *extra* value you look for because they're built to withstand years of heavy duty production line use with little or no maintenance.

Ask your Walker-Turner Distributor (listed under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) about the money-saving advantages of using W-T tools and components. He'll gladly show you the full line of Walker-Turner 20″, 17″, 15″ and new 14″ Hi Speed drill presses in a variety of floor, bench and single or multiple spindle models to fit *your* needs.

Carriage mounted special setup

For FREE CATALOG of the complete line W-T metalworking tools, write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WC-21, 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.



Equipped with multiple spindle attachment

WALKER-TURNER
LIGHT-HEAVYWEIGHT MACHINE TOOLS
another fine product by
ROCKWELL

Visit Walker-Turner in Booth No. 2236 at the A.S.T.E. Show

CIRCLE 310 READER SERVICE CARD

F Jos Lamb Co, Detroit machine tool builder, has appointed **C E Hitch** manufacturing manager. He was previously shop superintendent

R-O Manufacturing Co, Madison Heights, Mich, manufacturer of R-O universal form relieving fixtures, grinders, and attachments, has elected **William A Johnson** president

Minneapolis-Honeywell Regulator Co has named **James S Locke,** newly elected corporate vice president, vice president and general manager of **Brown Instruments Division.** Mr Locke, who had been vice president and general manager of the Micro Switch Division, will also be responsible for operation of the Valve Division and the Fall River, Mass Division

NAMES IN THE NEWS...

General Motors Corp has appointed **Philip J Monaghan** vice president in charge of the manufacturing staff. He has been vice president in charge of the process development staff and will continue in that post in addition to his new assignment.

Duff-Norton Co, Pittsburgh jack and hoist manufacturer, has promoted **Richard G Nolte** from vice president and general manager to executive vice president. **Cleighton Hilbert,** general manager of the Coffing Hoist Division, has been named vice president, manufacturing, and **T W Krueger,** general sales manager, has been appointed vice president and general sales manager.

General Mills Inc, Minneapolis, has named **James E Heath** director of manufacturing for the Mechanical Division which is engaged in design, development, and manufacturing of electronic and electro-mechanical devices and systems.

Allison Division of General Motors has promoted **Harold H Dice** from assistant general manager to general manager to succeed **E B Newill** who has retired.

Norge Division of Borg Warner Corp has elected **Robert H Quayle Jr** president. Formerly executive vice president, he succeeds **Judson S Sayre,** named board chairman and chief executive officer.

Kollsman Instrument Corp, Elmhurst, NY, has appointed **William A Matthews** works manager

Northwestern Electric Co, Chicago manufacturer of rotating electrical equipment, has elected **Wilson J Smith** vice president, manufacturing. He moves up from the post of works manager.

Rotor Tool Co, Cleveland, has appointed **Floyd L Paschke** sales manager. He has been serving as western application engineer in charge of sales in the midwestern and southwestern territories.

E W Bliss Co has appointed **Herman Schroll** sales manager for the Die Supply Division. Manager of the Division's Detroit district office since 1955, Mr Schroll's new headquarters will be at the Division's main office in Cleveland.

Metal & Thermit Corp, New York, has appointed **Robert T Brown** manager of the Welding Division. He replaces **A J Fisher Jr** who was recently named executive vice president of M&T. Mr Brown was formerly sales manager of the division.

H K Porter Co has appointed **Robert Brady** to the new post of manager of power tool sales of the **Disston Division.** He was formerly district manager of New York and the New England States.

Whitman & Barnes Division of the **United-Greenfield Corp** has appointed **R J Conroy** assistant sales manager. Formerly district manager of the company's Los Angeles office, he will make his headquarters at the W&B main plant at Plymouth, Mich, where the firm manufactures drills, reamers, and other cutting tools.

Stewart-Warner Corp, Chicago, has promoted **Walter Schmid** from chief process engineer to manager of manufacturing-engineering. **John Simkus** has been appointed superintendent of all Alemite and Instrument Division assembly operations and departments.

Robertshaw-Fulton Controls Co, Richmond, Va, has appointed **Thomas H Jeffers** director, facilities and tooling, with headquarters at the company's executive offices. He was formerly director of facilities and tooling, west coast operations.

Cincinnati Rubber Manufacturing Co has named **William V Shakespeare** president of the firm to succeed **L P Darnell** who has retired. Mr Shakespeare was formerly vice president of the company which is a division of Thor Power Tool Co, Aurora, Ill.

Budd Lewyt Electronics Inc, New York subsidiary of Budd Co, has appointed **Jerome G Friedman** general sales manager.

CONTROL

New machine with a memory licks a quality problem 3 miles long!

ANOTHER NEW IDEA FROM CUTLER-HAMMER

When manufacturers started ordering up to 16,000 ft. of tinplate in one coil instead of sheets, it created a serious problem.

You can control sheet quality by running each one through sensing stations and separating them by predetermined standards. But how do you check and control quality in over three miles of tinplate that's all rolled up?

For an answer, a leading tinplate producer came to Cutler-Hammer. Working with him, Cutler-Hammer engineers devised a simple, yet ingenious solution. They developed a new type of computer that hooks onto the same sensing stations used for individual sheets.

As miles of tinplate whiz by these sensing stations *before* it's coiled, this computer remembers every defect. Then, it automatically records every defect's type and location on a tape. After checking the tape, exact quality is known. Production controls can be adjusted quickly to compensate for any deviations from standards.

What's your problem?

Cutler-Hammer is on the move. It's brimming with new products—a limit switch, for instance, that's twice as dependable as the ones you now use. It has the ideas and the engineering talent for designing systems that automatically handle everything from blast furnace charging to quality control. And the addition of Airborne Instruments Laboratory's microwave and electronic experience gives Cutler-Hammer unmatched capability in all fields of industrial automation.

The new trademark you see above symbolizes the vitality, the capacity for ideas and practical assistance you can expect from the *new* Cutler-Hammer. Phone your nearest Cutler-Hammer office to put it to work for you.

WHAT'S NEW? ASK...

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wis. • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A.
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

CIRCLE 313 READER SERVICE CARD

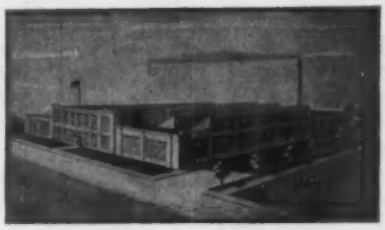
Here's how CDT can help you

CDT CAN INCREASE YOUR PRODUCTION
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
. . . by increasing the efficiency of your operation with special tools that do the job better—faster—more economically.

Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



FREE: *New brochure listing facilities, equipment, etc. Write today.*

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P.O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

NAMES IN THE NEWS . . .

Louis F Polk Sr, president of **Sheffield Corp** and director and vice president of **Bendix Corp** of which his precision instrument and machine tool company is a subsidiary, has been elected a Fellow of the American Society of Mechanical Engineers. The honor has been conferred upon him in recognition of his more than a quarter of a century of "acknowledged engineering attainment" in the fields of engineering, manufacturing, and precision measurement. Mr Polk has been a member of the Society since 1943, serving as a director and member of the council and its executive committee from 1953 through 1959, as well as chairman of its national board on codes and standards and other ASME committees.

Air Reduction Co, New York, has named **G C Cusack** president of **Pure Carbonic Co,** a division. Formerly executive vice president, he succeeds **J J Lincoln Jr** who has been transferred to the executive staff of the parent company.

Arrow Tool Co, Wethersfield, Conn, has appointed **Clarence J Cosgro** general foreman. Mr Cosgro was formerly associated with Gilbert & Barker Manufacturing Co.

MB Electronics, New Haven, Conn, division of **Textron Electronics Inc,** and a pioneer in the field of vibration, has appointed **E J Bligard** manufacturing manager. He was formerly plant manager of the Machine Shop Division.

Harnischfeger Corp, West Milwaukee, has appointed **Joseph Surmacz** plant manager. He was previously chief industrial engineer. **David Drewery** has been named director of production and industrial engineering, and **Robert Over** superintendent of machine shops, heat treat, salvage, and cutoff departments.

Controls Co of America, Schiller Park, Ill, has elected **Harold F Ames** a vice president of the company. He has also been named director of sales of the recently created Control Switch Division, a combination of the former subsidiary, Hetherington Inc, and the former Electrosnap Corp. Mr Ames was president and general manager of Electrosnap before its merger into Controls Co last December.

Gleason Reel Corp, Milwaukee, has named **C L Richards** manager of its Tormag Products Division. Tormag drives, manufacturing and sales rights of which were purchased from Whitney Chain Co in December, are being manufactured at the Gleason plant at Mayville, Wis. Mr Richards was formerly chief engineer of Whitney Chain Co, Hartford, Conn.

Girard Associates, Chambersburg, Pa, metalworking engineers, has appointed **Gunter Kohlmann** to be in charge of sale and service of company's line of optical marking projectors and cameras. Mr Kohlmann is a specialist in optical procedures for plate fabrication.

Dollinger Corp, Rochester, NY, has promoted **John J Hart** from research director to chief engineer.

Timesavers Inc, Minneapolis, has named **Gordon L Schuster** president. He was formerly president of the Despatch Oven Co. Mr Schuster succeeds **R F Pendergast,** founder of the company which manufactures wide belt sanding equipment; he will continue his association with the firm as board chairman.

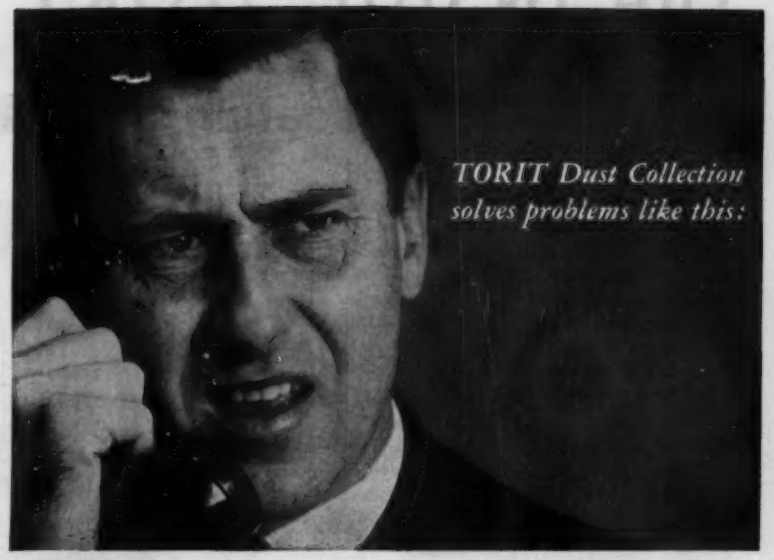
Winsmith Inc, Springville, NY, manufacturer of speed reducers, has appointed **John M Melisz** chief engineer. Mr Melisz was formerly assistant chief engineer of the Farnham Division of Wiesner-Rapp Co where he designed and engineered machine tools.

Burroughs Corp has appointed **Joseph B Rice Jr** general manager of the new ElectroData Manufacturing and Engineering Division in Pasadena, Calif. He was formerly director of manufacturing for ElectroData Division.

OBITUARIES

Harry Pelphrey, 57, director of research of **Michigan Tool Co,** Detroit, died Feb 18. Regarded as one of the country's leading research engineers on gears and gear manufacturing, he joined Michigan Tool's engineering department in 1929 and served as assistant to the chief engineer, gear and development engineer, and as director of research since 1957.

Walter Enos Rogers, 73, formerly general sales manager of **Taft-Peirce Manufacturing Co,** Woonsocket, RI, died Feb 13.



"6 MEN OUT AGAIN TODAY?" "WHY?"

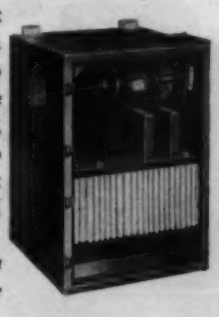
"I was on the receiving end of that question. And I knew what the boss was driving at. Production-wise, we couldn't stand our current rate of absenteeism. Even the men on the job were dragging their feet. To show you what I mean: we had just lost one of our best customers. Reason: one too many late shipments.

"Logically, when sickness strikes, you consult a doctor. Which is what I did. Without actual examinations, he couldn't diagnose the trouble. But he did give me the clue when he asked, 'How are your working conditions?'.

"Frankly, our plant is dirty. Or better put, dusty. With grinding machines running 24 hours a day, how could it be anything else? With that thought, I remembered. A salesman had been in my office just the other day talking about dust. I had too many production headaches at the time to hear him out. But I kept his card. So I called him back.

"He was from Torit. He was selling Torit Dust Collectors . . . machines that trap dust. When I compared the low cost of his equipment with the high cost of our production lag, I decided it was worth a try. So I bought one . . . just one, to start, for $285.00. We installed it ourselves on a key machine.

"The change in the man operating that machine sold me. Within a month, we had a Torit Dust Collector system attached to seventeen dust-producing machines in the plant. As a result, the air in our plant is clean, the way it should be. Our absentee rate is no longer a problem. Our production rate is at top speed. And you know something? I feel better myself!"



Is dust doing you dirt? For complete facts on dust damage . . . and how to control it . . . write:

TORIT manufacturing company

Dept. 421, 1133 Rankin St., St. Paul 16, Minn.

The INSIDE STORY about NATIONAL Keyseating Millers

NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed steel which are hardened to Rockwell specifications and accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

national
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complete, handy size

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Use rugged, reliable "Hole Hog" machine tools for such jobs as:

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★ Straight Line Multi-Drilling ★ Adjustable Spindle Drilling
★ Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
★ Special Multiple Operation Machine Tools

Twenty-Station, Ten-Unit Transfer Machine for boring, counterboring, chamfering and valve clearance operations on V-8 automotive engine blocks. (Shown)

Over 58 years of MachineTool Engineering experience is at your service. Tell us your particular problem.

MOLINE TOOL COMPANY
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REPRESENTATIVES IN PRINCIPAL CITIES

NEW BOOKS...

GENERAL METALS. *By John L Feier (2nd Edition). Published by McGraw-Hill Book Co Inc, 330 W 42nd St, New York 36, NY. 372p, 9¼ x 7½. Price $5.48*

A basic text at about the 9th Grade level, this new edition retains the major features of the original as regards general arrangement and treatment. It has, however, been largely rewritten to keep pace with the improvements in metalworking operations. New sections have been added on machine bending and forming, metal enameling, spotwelding, and milling, and the sections on foundry work, welding, and machine shop have been considerably expanded. There is new information on metals, materials, and processes, and most of the illustrations are new. Color is employed to stress safety angles and to act as a teaching aid. Six film strips have also been developed for use with the book.

Within the limits of its audience, the book treats of metalworking design and layout, bench work and wrought metal, sheet metal, art metal and jewelry, forging, heat treating, foundry, welding, machine shop operations, and the stories of steel, copper, and aluminum. The final chapter suggests various projects in each of the fields considered.

•

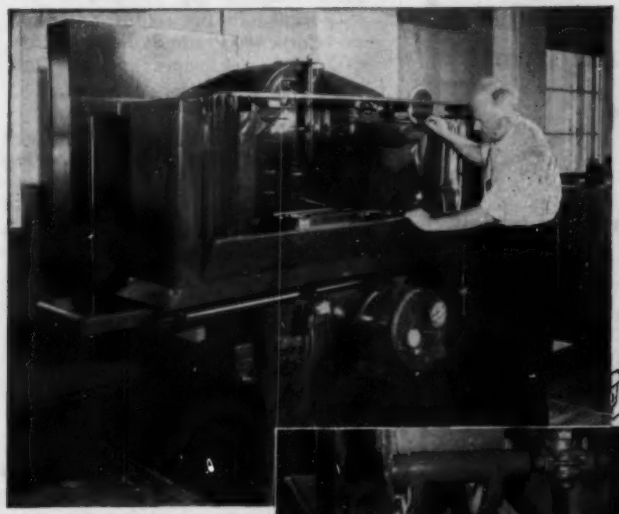
X-RAY WAVELENGTHS FOR SPECTROMETER—*Published by General Electric Co, X-Ray Dept, 4855 W Electric Ave, Milwaukee, Wis. 448 pages. Price $10.*

Book is designed for routine use with an X-ray spectrometer, primarily an X-ray emission instrument for qualitative and quantitative chemical analysis of elements.

First two sections are for qualitative analysis from observed angles to their identification in terms of element, line or absorption-edge designation, wavelength, and order of reflection. Tabulation is for crystals ADP, EDT, quartz (6.68), silicon, NaCl, LiF, quartz (2.75), and topaz. Absorption edges are included. Data in order of increasing Bragg angle and both lambda and n lambda are recorded. Remaining eight sections, one for each crystal, are a guide for spectrometer adjustment, giving angle position from systematic arrangement of element and line designation.

Wavelengths are given in angstrom

Thompson — TRUFORMING CUTS COSTS 60%



For 140 years, the policy of The Draper Corporation of Hopedale, Mass., has been to offer the highest quality product at the least possible cost.

Following this policy, its subsidiary, BlueJet Corporation, manufacturers of the famous BlueJet saw chain, installed a Thompson Truforming grinder to grind the cutting edges on their chain saw routers. These routers were formerly ground, piece by piece, by a force of 8 employees.

The Thompson Truforming operation is now cutting former grinding costs by 60%. 3 men only are now required for the operation. 40 L.H. and 40 R.H. routers are now ground simultaneously with one pass of the crush formed wheel, resulting in a day's production of over 12,000 pieces—many times that produced by the former method. Both the uniformity and sharpness of the routers have been greatly improved.

For 25 years, Thompson has pioneered and developed the modern advances in crush form grinding. If you have a time-saving, product-improving or cost-cutting problem in your operations, it will pay you to investigate the work Thompson Truforming grinders are now doing in plants all over the country. Our engineering experience is available to you without obligation. Write for Catalog T558.

"Keep Thompson in mind for the daily grind"

THE THOMPSON GRINDER COMPANY

SPRINGFIELD, OHIO

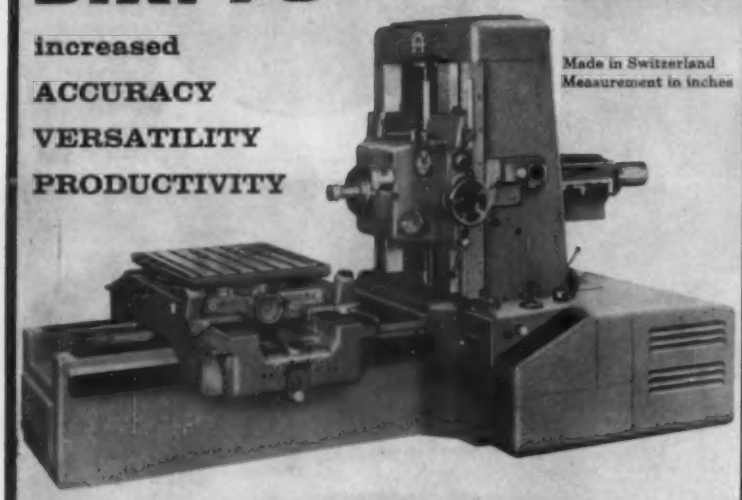
SURFACE GRINDERS

CUT ACCUMULATED ERRORS to a minimum

with the

DIXI 75 horizontal optical jig borer

increased
ACCURACY
VERSATILITY
PRODUCTIVITY



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Measurement in inches

- Automatic positioning can be changed instantly to manual operation
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- Simplified controls functionally arranged for greater operating speed and efficiency
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- Hydraulic feeds and infinitely variable spindle speeds
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units calculated from data in X units. Interplanar spacings of the crystal analyzers were determined experimentally and checked against various published sources.

•

MOLECULONICS—*By Edward L Holbrook. Published by Modernair Corp, 400 Preda St, San Leandro, Calif. 54 pages, pocket size. Price $1.00.*

Non-commercial, educational book contains 54 diagrams illustrating various applications of fluid power circuits to solve special control and automation problems. Author is a fluid power engineer with a background of 30 years' experience in pneumatics and hydraulics.

•

NEW FILMS...

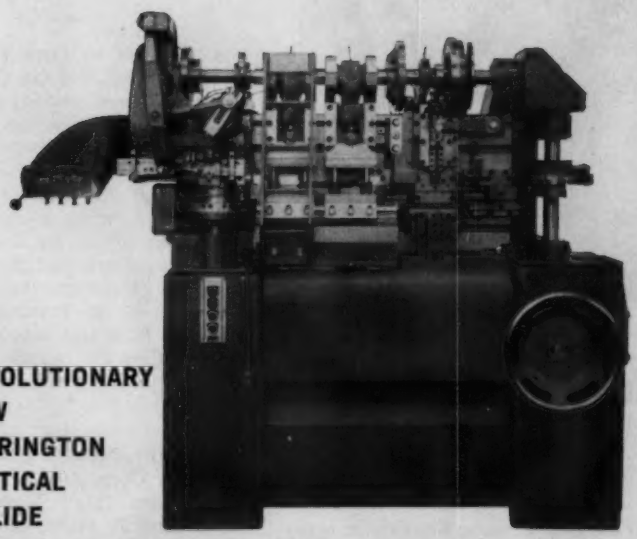
NEW FASTENING METHODS. *Produced by Huck Mfg Co, Detroit, Mich. 16mm, sound, color. Running time 13 min.*

That any procedure which is faster, better, safer, and quieter than present assembly practice is more economical in the long run, is the main point of this film. Promoting the use of Huckbolt fasteners, the picture employs unusual cross-section closeups, using actual parts rather than animation, to show how the special collar is progressively swaged into the locking grooves of the pin. The high magnification in these "time-lapse" shots is such that the flow lines in the metal collar are clearly visible, conveying a much more useful and believable effect than would be produced by drawings.

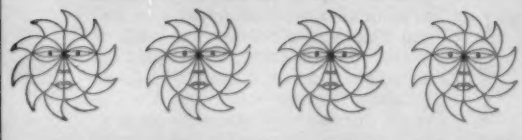
•

CAST METALS AND YOU. *Produced by American Foundrymen's Society, Golf & Wolf Rd, Des Plaines, Ill. 16 mm, sound, color. No charge to educational institutions and civic groups, $10 fee to others.*

Depicts the vital role of metal castings in the every-day life of modern man. It shows the transformation of the foundry from a personal art, to a small handwork operation, to the broad use of science and engineering in modern industry. Scenes include training programs, patternmaking, design clinics, and laboratory facilities of foundries and engineering colleges. The broad



REVOLUTIONARY NEW TORRINGTON VERTICAL 4-SLIDE



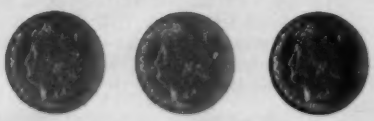
PAID FOR ITSELF IN FOUR DAYS

PRODUCING THIS PART

Close-tolerance enameling wiper die . . . having 26 critical dimensions . . . produced by General Electric Industrial Heating Dept.

AT FOUR TIMES THE SPEED

With one machine replacing five progressively tooled OBI presses . . . and producing the part in one-fourth the time.



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Saving $13,500 on a single production run of only three days duration!

This important new production tool, the Verti-Slide, offers sensational savings in direct and indirect labor costs, parts inventory, and floor space requirements . . . through elimination of secondary operations, drastic reduction in production man-hours, and lower tooling, down-time and materials handling costs. Write or call today for complete technical data . . . or a Torrington sales engineer.

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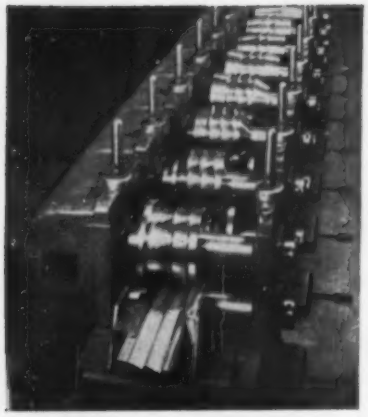

Yoder Roll-Forming Equipment mass-produces shapes accurately, economically

Yoder Roll-Forming Equipment, even with part-time operation, can effect significant savings in many metal working applications and industries. Shapes, simple or complex, can be quickly and economically produced the Yoder way from a wide variety of flat-rolled coated or uncoated stock ... in thickness up to ¾ inch ... in speeds up to 50,000 feet per day.

Yoder engineers flexibility and precision into metal forming operations. For example: many basic shape modifications, such as coiling, welding, notching, ring-forming, perforating, and cutting to length can be simultaneously accomplished with little or no additional labor cost.

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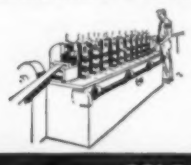


YODER COLD ROLL FORMING MACHINES

scope of this film should give it appeal to industrial groups, civic organizations, PTA groups, students, and vocational guidance counselors.

•

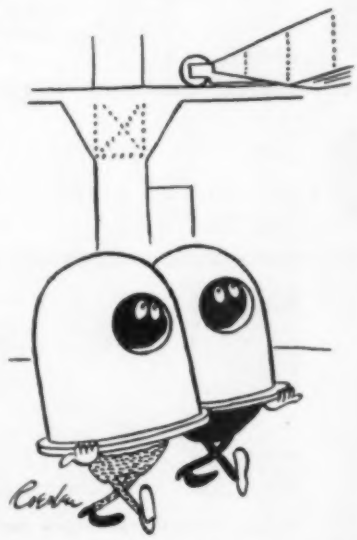
FIRE BARRIERS BY OVERLY. *Produced by Overly Mfg Co, Greensburg, Pa. 16 mm, sound, color. Running time 8 min. No charge for loan. Purchase price $65.*

Actual UL fire tests of the manufacturer's new metal-and-glass fire and smoke screen are shown in this film. Also illustrated are examples of how such screens may be placed in corridors of hospitals, schools, and other buildings to provide refuge areas within the building.

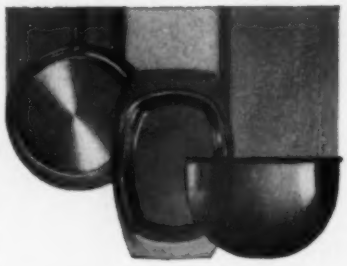
•

NUMERICAL CONTROL MANUFACTURING. *Produced by Bendix Aviation Corp, Industrial Controls Section, 21820 Wyoming Ave, Detroit 31, Mich. 16 mm, sound, color. Running time 22 min.*

Designed as part of an over-all program for showing all levels of production management the operation and advantages of numerically controlled machine tools, this film shows the advantages and cost savings resulting from the use of such machines. A complete description of the Bendix system is presented, and machine tools are shown in operation in the plants of leading manufacturers producing such parts as cams, dies, turbine blades, and structural parts.



"I hate breaking in a new crane man!"



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Your J&L stainless steel distributor can serve you better *because J&L serves him better,* backing him with the full facilities of J&L's Stainless and Strip Division.

Your J&L distributor can reduce your costs by providing a complete range of pre-production services, and doing it economically! He can save you the capital investment required to maintain long term inventories; and can help you eliminate the costs of overhead connected with stocking, accounting, and the inevitable losses incurred through waste and obsolescence due to specification changes.

Technical assistance in solving production problems is also available from your J&L distributor. And when those problems are connected with an application using stainless steel, J&L's own staff of technical specialists will promptly answer your distributor's call for additional help.

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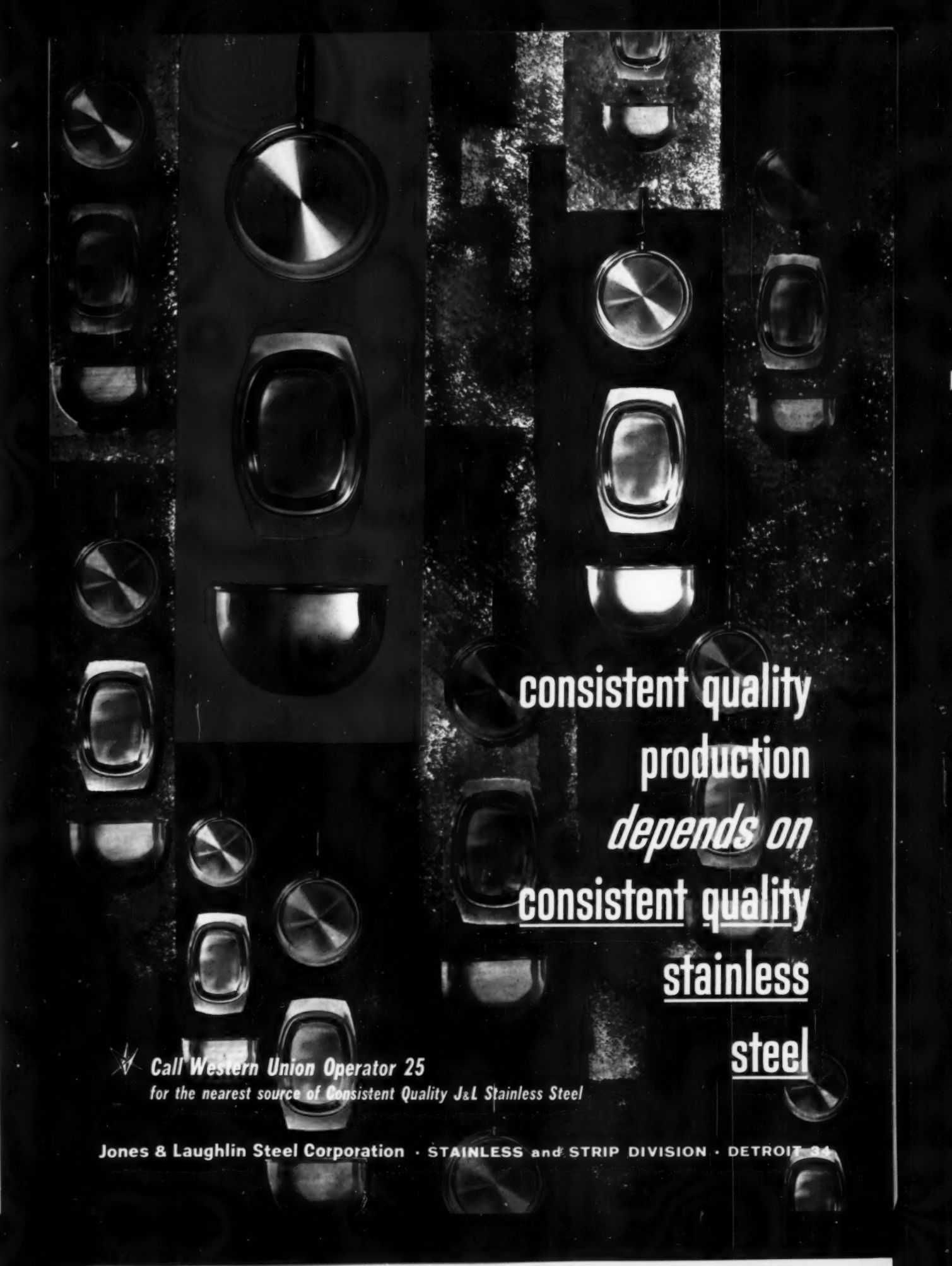
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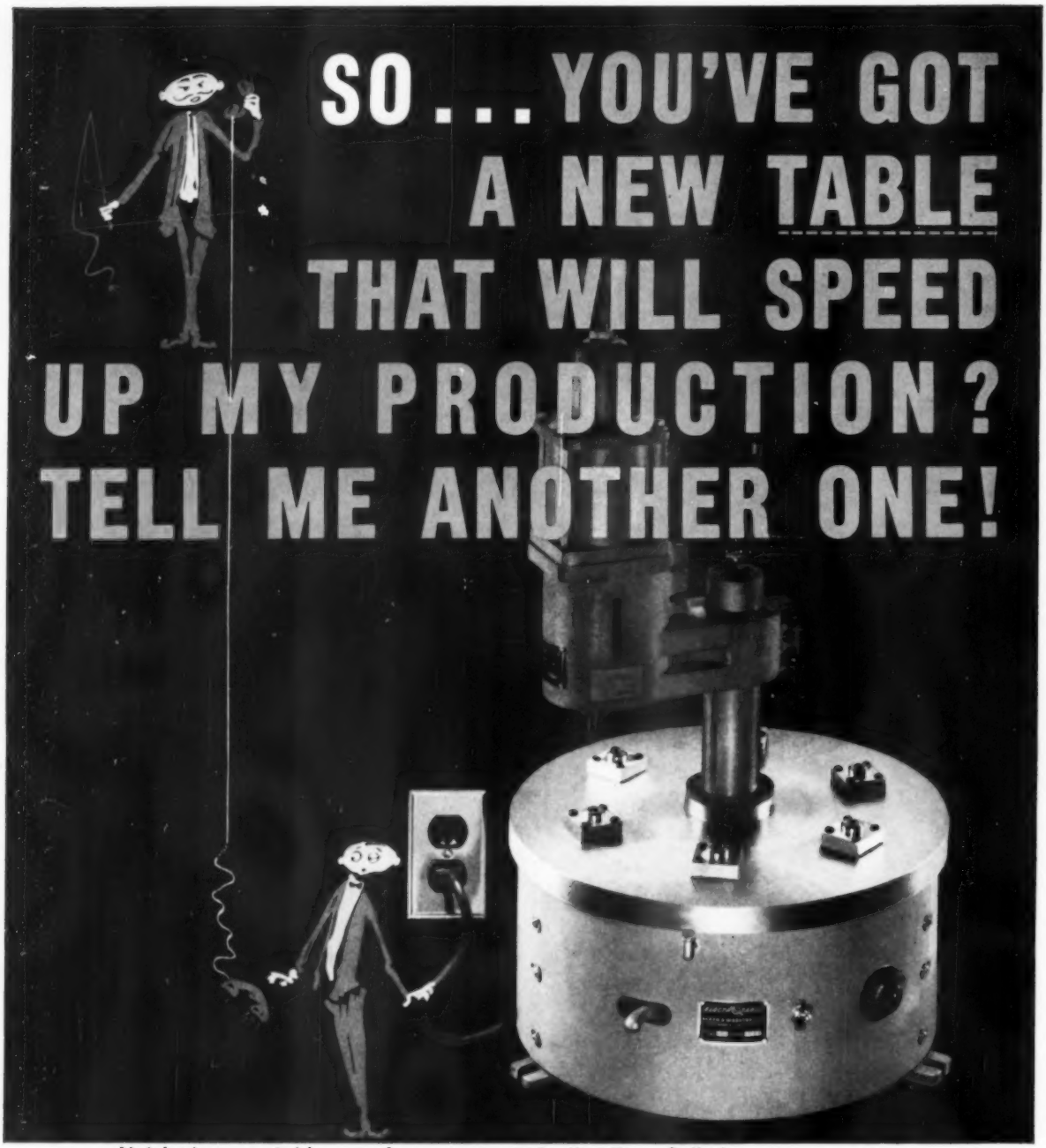

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Model LT — Counterclockwise Rotation

Model RT — Clockwise Rotation

Stations — 6, 8 and 12

Speed — continuously adjustable between 14 and 48 indices per minute.

(A timer that will provide 6 to 25 indices per minute is also available.)

Time for motion during one index .693 seconds

Indexing accuracy, ±.001

Diameter of table — 15¼"

Height of table above bench, 7¾"

Weight of unit less Electropunch head — 82½ lbs.

Electrical requirement: 115V or 230V AC, 50-60 cycle, 1 phase

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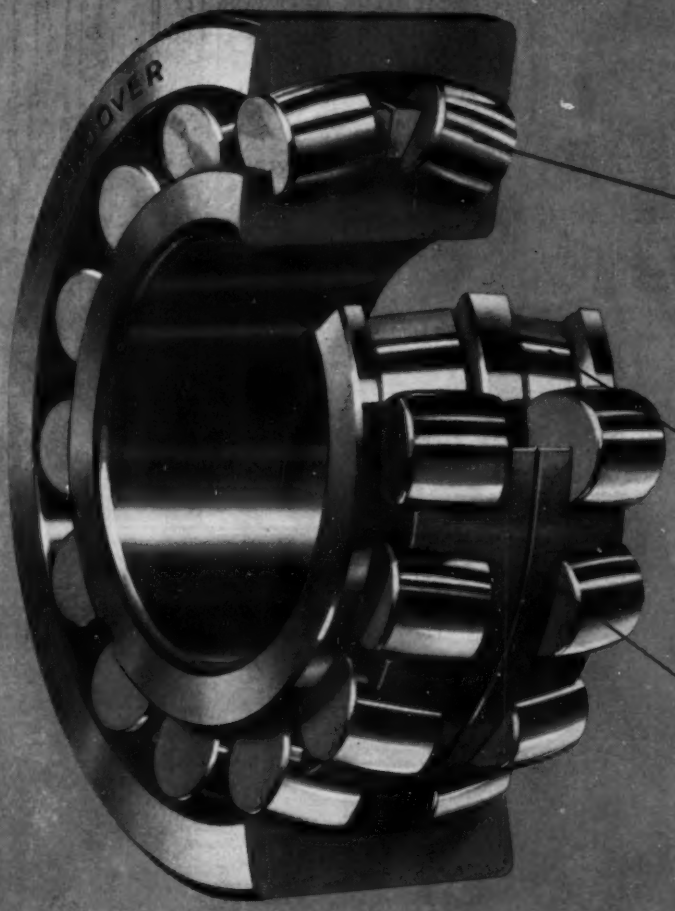

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Land-riding retainers are accurately machined from solid bronze for proper roller guidance and uniform load distribution.

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☐ Have your representative call.

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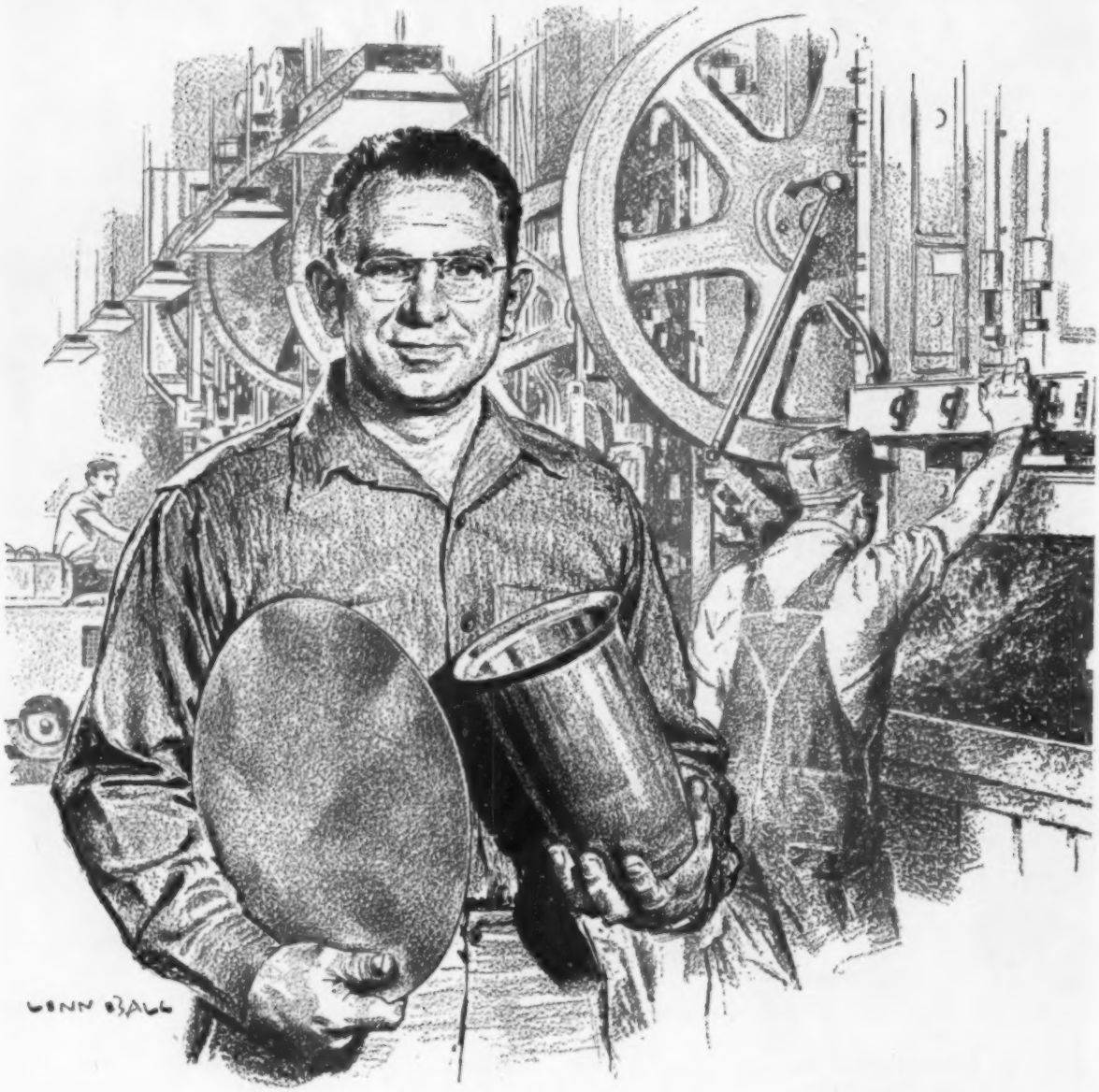

"For extra deep drawing we like Sharon Quality Stainless Steels"

— WALTER MARKOWSKI, Pressroom Foreman
S. W. FARBER, Inc.

"Here at Farber we really put stainless steel through severe tests," says Walter Markowski, pressroom foreman. Our product design calls for extra deep draws, delicate rolled edging and bright flawless finishes. Over the years we have found a most dependable source of prime stainless steels in the *Sharon Steel Corporation, Sharon, Pa.*"

SHARONSTEEL **SHARON** *Quality* **STEEL**

WHATEVER YOU WANT A PRESS TO DO...

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Bliss makes more types and sizes of presses than any other builder

No matter how big or how complex that next metal stamping job may be, it makes sense to call on Bliss. Size never has presented any problem to us, and complexity is our specialty. And because Bliss makes more types and more sizes of presses than any other builder in the business, you're sure to get impartial counsel—sure that your trained Bliss representative will "grind no axe" for any one type of press. And remember this: he's backed by more than a century of experience in building presses of all types, all sizes, for all kinds of industry.

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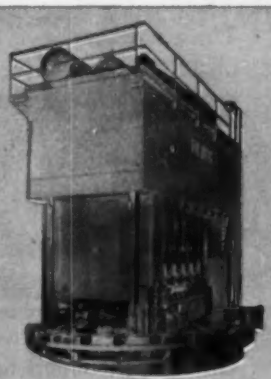
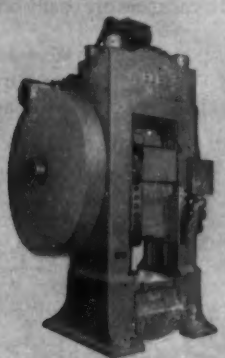
INCLINABLE PRESSES . . . in bench, single or double crank, modern enclosed design. With air friction or mechanical clutches, and whatever you need in cushions and feeds.

STRAIGHT SIDE PRESSES . . . eccentric and crankshaft models . . . any size . . . modern enclosed design, with whatever automatic features you want.

HIGH PRODUCTION PRESSES . . . specially designed for continuous high speed automatic operation. Up to 1000 spm. Available in a variety of sizes . . . and precision feeds.



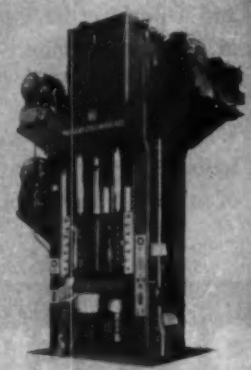
TRANSFER FEED PRESSES . . . for the ultimate in production. Bliss pioneered the development, now builds them for blank or coil stock work, with no limit on size.



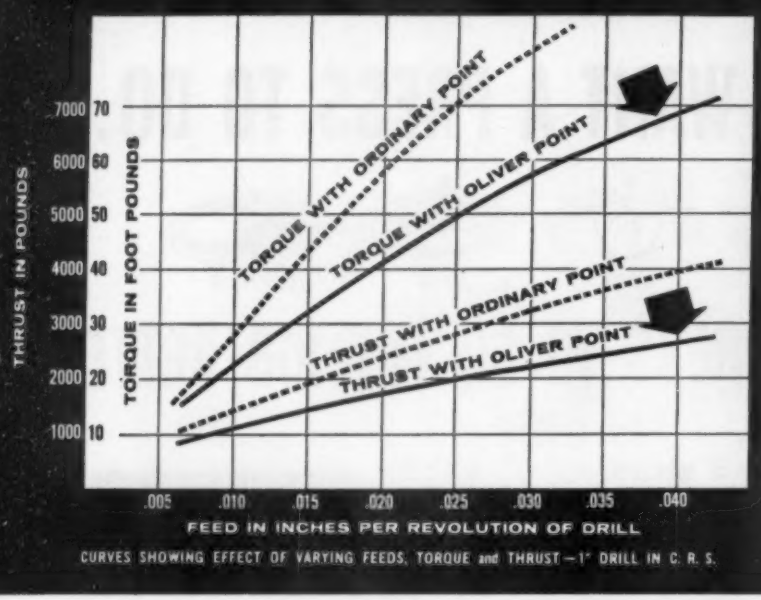
KNUCKLE JOINT PRESSES . . . for slow, powerful application of pressure at near-bottom stroke. Bliss builds them from 75 to 10,000 tons capacity in 40 standard models for coining, embossing, extruding, sizing and swaging.

FORGING PRESSES . . . for production of turbine blades, crankshafts — hot forging, cold coining and other operations. Built in a number of sizes, from 300 to 4000 tons capacity, to standard and special design.

TOGGLE PRESSES . . . Double and triple action designs with quick advance and return speed features; modern electronic controls and automatic lubricating systems. From giant "automotive" sizes to compact units for small parts.



HYDRO-DYNAMIC® PRESSES . . . single action or double open rod construction or closed, 20 tons capacity to 35,000 or even more, standard design or special high speed models, electronic controls —Bliss has built them all.



CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST—1" DRILL IN C. R. S.

OLIVER'S UNIQUE DRILL POINTER gives you more holes per grind

Substantially less torque—much less thrust!

The above graph is a typical test run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. Each lip does its equal share and the theoretically perfect point permits easier penetration. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves. *The Oliver point has been successfully used since 1921.*

Oliver drill pointers are rugged enough to stand up to every day pounding. Features of the Model #510 include: a universal chucking head which holds drills from ¼ to 3 inches in diameter and swivels to give varying angles from 82 to 160°; an adjustable cam to give a variable amount of clearance at the cutting edge; and a positive drive to the chuck. In addition, all main shafts—including the grinding wheel spindle—are mounted on anti-friction bearings.

Want proof? Oliver will sharpen *your* drills on a "no-charge" trial basis. Write today for full information. We'd like the opportunity of sending a quotation.

OLIVER of ADRIAN

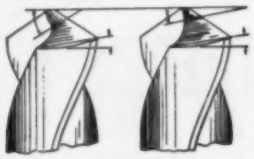
1414 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS–TOOL AND CUTTER GRINDERS–AUTOMATIC AND MANUAL FACE MILL GRINDERS–TOOL BIT GRINDERS–CONTOUR SAWING AND FILING MACHINES.

(Advertisement)

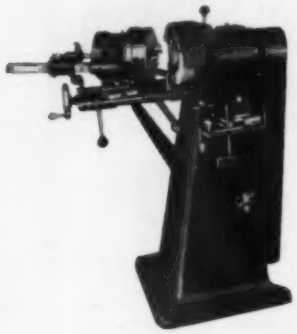
HOW TO REDUCE YOUR TWIST DRILL COSTS

Any substantial reduction in drill costs must be made by choosing a combination of the right drill design *and drill point.*



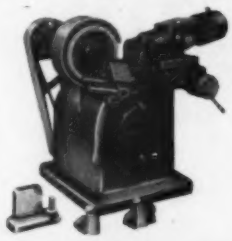
The sketch above shows a comparison of two drill points. The one on the right is as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

It is a widely accepted fact that for a given feed the angle of helix of the feed is greater as it approaches the center. It is this reason that makes increased clearance at the center of the drill point so essential. The Oliver pointers provide average thrust reductions of 25.2% and average torque reductions of 22.0%.

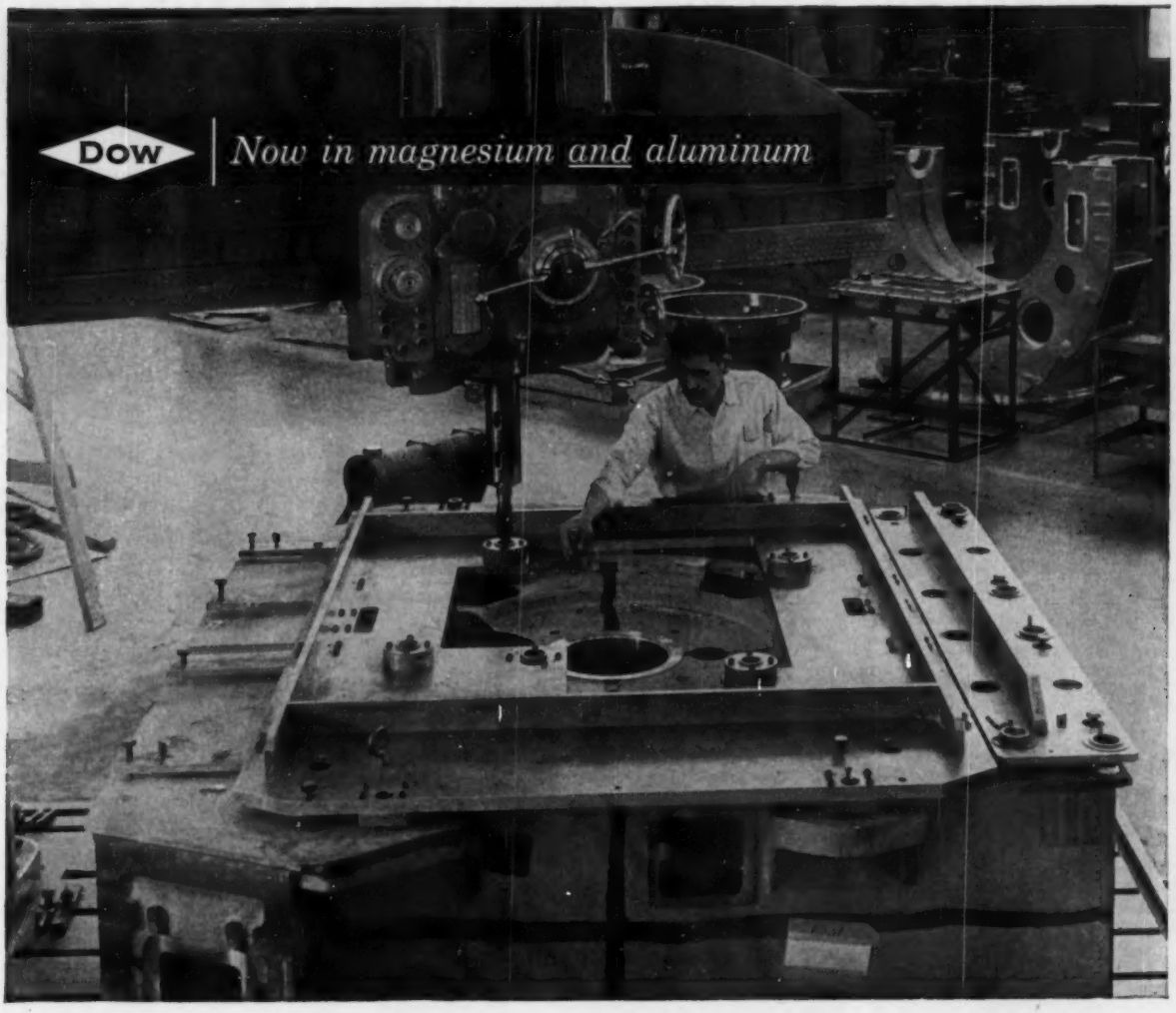


The Oliver 510 makes possible the trouble free grinding of drills—whether 2, 3 or 4 flute. Variable included point angles and clearances are easily obtained.

This cost-saving point is also available by using the new heavy-duty #21 bench model machine. Capacity is



3/32" to ½". A 5" diameter cup wheel and a built-in diamond dresser provides for easy operation regardless of drill size or included angle.



TOTEABLE MAGNESIUM HELPS TOOL HUGE NIKE ANTENNA

"We're using more and more magnesium tooling plate in our shop because it's lightweight, easy to machine and has a superior finish," says the Director of Engineering of Steel Products Engineering Company Division of Kelsey-Hayes.

Light Weight. "We use magnesium tooling plate to make jigs and fixtures of various sizes up to seven feet square in our work on the huge Nike-Hercules antenna," he said. "The largest magnesium tools can be transported with a small lift truck, leaving our overhead crane free for other duties. Many of the magnesium tools can be handled easily by one or two men."

Machinability. "The excellent machinability of magnesium is very important since many operations must be performed to get the two sides of our jigs and fixtures parallel to .001."

Dimensional Stability. "Magnesium's dimensional stability allows us to hit milling and drilling tolerances on the finished antenna parts of .0002 to .0005."

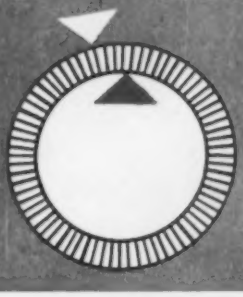
NEW Magnesium Tooling Plate Manual covers shop working characteristics, properties, design. Contact the Dow sales office near you or write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Department 1030F3-21.

See "The Dow Hour of Great Mysteries" on NBC-TV

DOW **THE DOW METAL PRODUCTS COMPANY**

Division of The Dow Chemical Company

I.D. OR O.D.

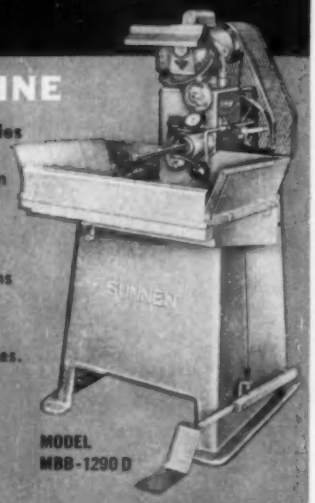


SUNNEN HONING ASSURES FAST STOCK REMOVAL

and Guarantees 4-Way Accuracy

① SIZING ② ROUNDNESS ③ STRAIGHTNESS ④ SURFACE FINISH

SUNNEN PRECISION HONING MACHINE



For quick economical work on open, tandem or blind holes in any material, from stock removal through finish sizing . . . from deburring through micro-fitting. Guarantees production tolerances to .0001" or when required down to .000025" (25 millionths) without chucking or use of jigs or fixtures.

Produces geometrically true round holes. Corrects out-of-round conditions left in work from previous operations with a minimum of stock removal.

Levels out internal irregularities for end to end precision. Corrects taper, waviness, bow, barrel and bellmouth in holes.

Generates desired surface finish consistently—down to 2 microinches with no "heat checks" or smear metal.

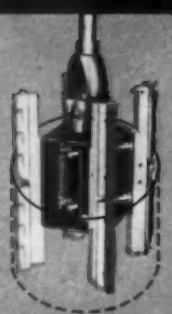
I. D. RANGE—.100" through 2.625" with stock tooling and through 4.500" with tooling built on order.

AVERAGE INSTALLATION WITH TOOLING, COSTS APPROXIMATELY $1000

MODEL MBB-1290D

For details, ask for your copy of BULLETIN X-MAN-5000I

SUNNEN PORTABLE HONES



The "tools of a thousand uses." *Size and finish holes anywhere in any position.* Excellent for small lot production...for large or heavy parts . . . for sizing or correcting undersize, tapered, out-of-round, barrel, bellmouth etc. and for "on-the-job" re-sizing of holes in machine repairs.

- Remove stock fast in any material.
- Consistently accurate to within .0005".
- Consistently produce smooth surface finishes, down to 5 microinches when desired.
- Generate geometrically round and straight bores.
- Available for 1¼" thru 20½" hole dias.
- Eliminate need for jigs or fixturing.
- Require no expensive set-up time.
- Powered by portable drill, drill press etc.

For details, ask for your copy of BULLETIN X-AN-5001E

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For fast accurate O.D. sizing and precision finishing of ⅛" through 2¾" shafts, arbors, spindles, plungers, leader pins, plug gages and many other parts. Ideal for toolrooms, machine shops and close tolerance production work. Correct errors from previous operations such as grind patterns, cloverleaf, rainbow, taper, bow and out-of-roundness. Hold tolerances to .000025" (25 millionths) if needed and produce surface finishes down to 2 microinches.

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Ask for a free equipment demonstration or send us data on your specific problems. We'll welcome the opportunity to work with you.

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SUNNEN PRODUCTS COMPANY HONING

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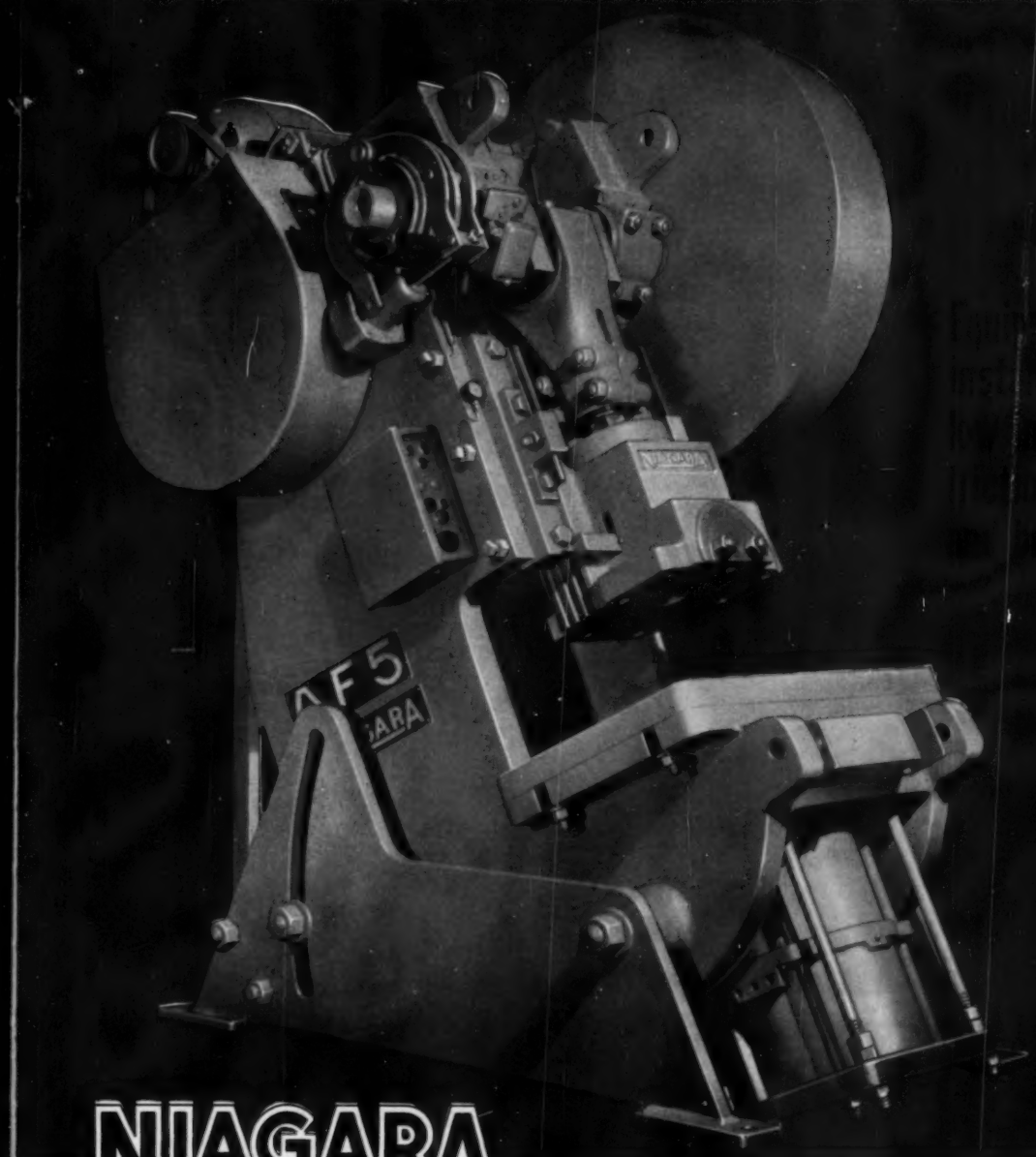
A GREAT NEW LINE* JOINS NIAGARA'S BIG OBI FAMILY



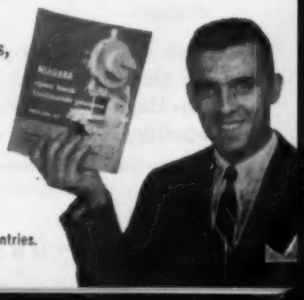
NIAGARA

Meet the new Series AF. Look it over . . . typical Niagara engineering from crown to base . . . every detail a benefit to you.

- Rugged, rigid frame for greater accuracy, longer die life.
- Unusually long, rigid slide of unique design prevents deflection of ways, solidly supports dies and extends their life.
- Exclusive multiple "V" gibbing for more guiding surface and greater resistance to off-center loads.
- Cool-running, long-wearing, pneumatic friction clutch and brake operate directly on the crankshaft . . . fewer parts to start and stop . . . faster engagement.
- Modern, rigidly supported gearing runs in sealed oil bath for long life.
- Simplified control for safer, time-conserving press operation.
- Patented one-man inclining mechanism.
- Full complement of accessories to meet your specific needs.

Look at the range: 14 sizes, geared and non-geared, shaft diameters 1¼" to 7½", capacities 5½ to 250 tons.
Niagara Machine and Tool Works, Buffalo 11, N. Y.

Now get the whole story . . .
Send for New Bulletin 55.



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what do you need in an adjustable speed drive?

7½ hp Ajusto-Spede Drive

Common motor-drive housing for units up to 7½ hp saves space — can be foot- or flange-mounted. Larger sizes up to 100 hp with individual motor and drive housings mounted integrally.

The Louis Allis AJUSTO-SPEDE® drive is more compact, precise, and trouble-free

Here's an adjustable speed drive that allows *truly precise* machine operation. Speed regulation is automatic and stepless — results in faster, more efficient production at lower cost, with less waste, and minimum wear on equipment.

These and other benefits are yours when you use the improved Louis Allis Ajusto-Spede drive. For example, it can be set before or during operation to deliver any desired speed within its range. Its *exclusive* tachometer feedback circuit monitors the output speed and *automatically corrects speed and holds it* regardless of load changes.

This improved drive requires minimum maintenance. Its stationary field has no brushes, commutators, or slip rings to cause trouble. The source of power is an equally trouble-free standard a-c squirrel cage motor.

®Ajusto-Spede is a registered trademark of the Eaton Mfg. Co.

The cast-iron housing keeps out dirt, chips, and moisture — resists corrosion.

The compact Ajusto-Spede also saves space. Integrally-mounted motor and drive simplify handling — can be easily adapted for installation on new or existing machines. Controls can be mounted at the machine or any other convenient position.

The Louis Allis Ajusto-Spede drive is the practical solution to almost every application that requires dependable, easily controlled adjustable speed. It is the answer to precise operating speeds for machine tools, process machinery, test equipment, windups, conveyors, printing presses, and other equipment. Contact your Louis Allis District Office for information and application help. Or write for bulletins 2750 and 2800 — The Louis Allis Co., 452 E. Stewart St. Milwaukee 1, Wis.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

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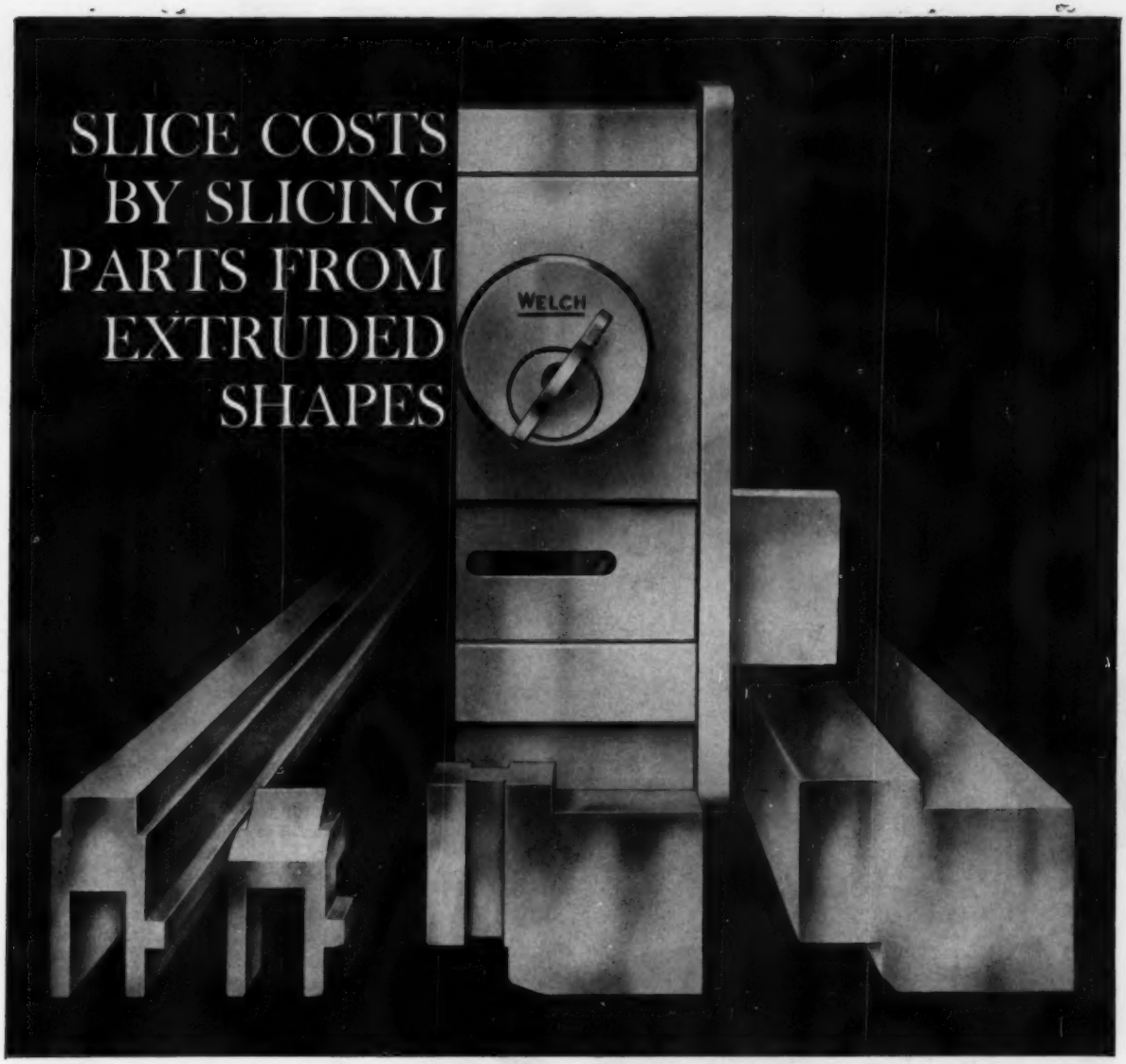
SLICE COSTS BY SLICING PARTS FROM EXTRUDED SHAPES



Fabricating parts from long lengths of "premachined" shapes reduces machining, scrap, and finishing

The lock components shown above are typical of some 20 different precision brass parts which Welch, Inc., Waukegan, Ill., makes for its broad line of locks and latches, from Anaconda extruded shapes.

Welch works closely with Anaconda specialists from early design stages. New lock mechanisms are built around parts which can be cut by a metal slitting saw from long lengths of extruded shapes with minimum subsequent machining and scrap. The use of bar stock is never considered when there is the slightest possibility of designing savings into a part by means of a brass extrusion.

Superior quality, too. Parts made from extruded shapes are characterized by their strong, homogeneous, wrought-metal structure. And the smooth, extruded surfaces reduce many finishing operations.

More and more manufacturers are cutting fabricating costs *and* maintaining quality by using these preformed or, in effect, "premachined" shapes. For imaginative and practical help in adapting extruded shapes to the economical production of intricate parts, call your Anaconda representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6044

Extruded Shapes • Special-Shape Tubes • Die-Pressed Forgings

ANACONDA®

products made by The American Brass Company

Such accuracy is easily held on Snow machines. They show up best on hard-to-hold, tough steel parts where accuracy and quick changeover are important. They cut production costs, help you to make reliable deliveries of high quality parts. Snow has 3 types of machines for tapping (see below). On your next job let us show you what the Snow method can do. We invite samples and prints.

SNOW NUT TAPPER (like above). Hopper can select flanged nuts FACE DOWN.

SNOW HORIZONTAL MACHINE For special parts that need clamping. Hopper or hand feed.

SNOW VERTICAL MACHINE For short runs on a quickly changed dial index plate.

Snow Manufacturing Co., Dept. A, 435 Eastern Avenue, Bellwood, Illinois. Telephone, Chicago, EStebrook 8-7142

SNOW *master fixtures save dollars and days in tooling costs*

The next one will be "just like the first one" from this Heppenstall Die Block.
Die block dimensions: 13'2" x 2'7" x 1'4"
Weight before sinking: 23,830 pounds

Heppenstall Die Blocks reduce sinking time . . . hold close tolerances for these 3500 lb. crankshafts

Reports from Park Drop Forge Company, Cleveland, point out two important performance benefits resulting from the Heppenstall Die Blocks used for this diesel crankshaft job. First, the machinability of Heppenstall's Hardtem Die Steel made it possible to sink the impression in a minimum of costly machining time. In addition, Hardtem's outstanding ability to hold dimensions under the hammer enabled the company to turn out close tolerance forgings throughout the entire production run. Since 1937, when the diesel trend began, the majority of locomotive crankshafts have been Park Drop forgings . . . and most of them from Heppenstall Die Blocks.

Forged on all six faces from special Heppenstall Steel, Hardtem and other Heppenstall Die Steels are manufactured in a wide range of hardnesses to match varying customer requirements of application and machinability. Veteran Die Sinkers know they can select a Heppenstall Die Steel that can be machined to greatest accuracy in minimum cutting time, yet will hold dimensions for maximum production runs. If you're looking for the best possible combination of die block machinability and service life, contact your Heppenstall Representative. He can help you quickly select the one best answer.

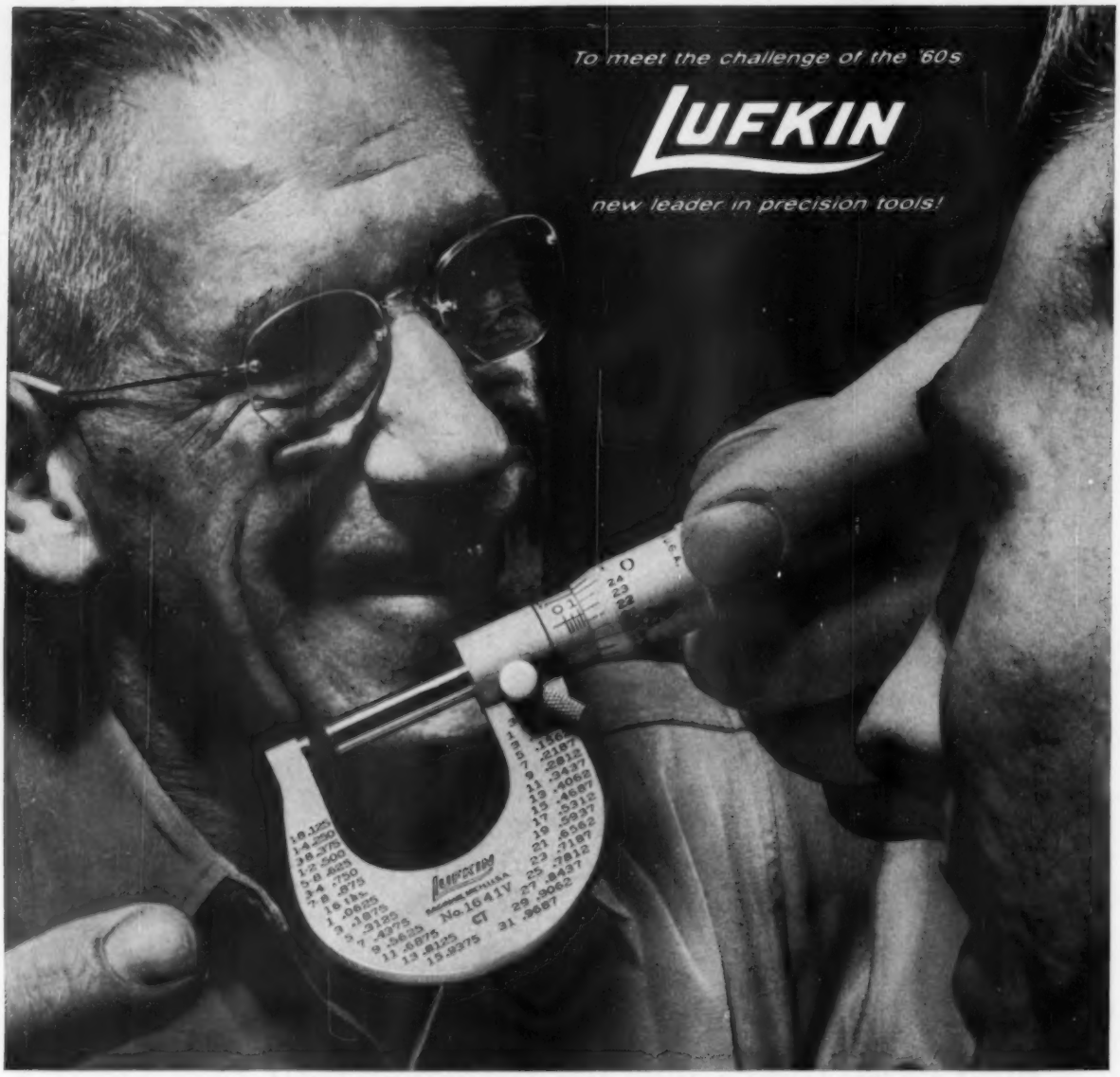
These four Heppenstall Warehouses carry stocks of the most popular size die blocks:

Bridgeport 5, Connecticut • Detroit 32, Michigan • Los Angeles 22, California • Pittsburgh 1, Pennsylvania

HEPPENSTALL COMPANY
PITTSBURGH 1, PENNSYLVANIA
Plants: Pittsburgh, Pa. • Bridgeport, Conn. • New Brighton, Pa.

MIDVALE-HEPPENSTALL COMPANY
NICETOWN, PHILADELPHIA 40, PA.

Die Blocks • Forgings • Back-Up Roll Sleeves • Rings • Industrial Knives • Materials Handling Equipment
Pressure Vessels • Hardened and Ground Steel Rolls • Vacuum and Consumable Electrode Melted Steels



"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

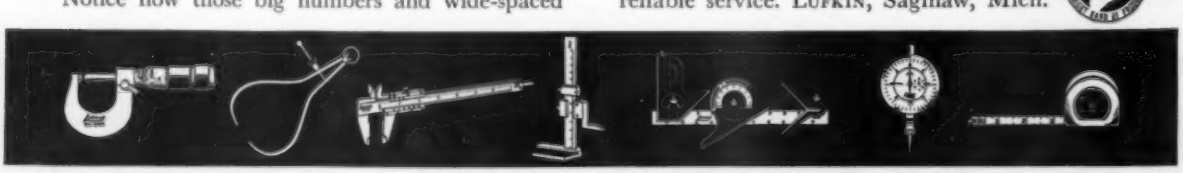
Lufkin micrometers have 5 to 7 fewer parts."

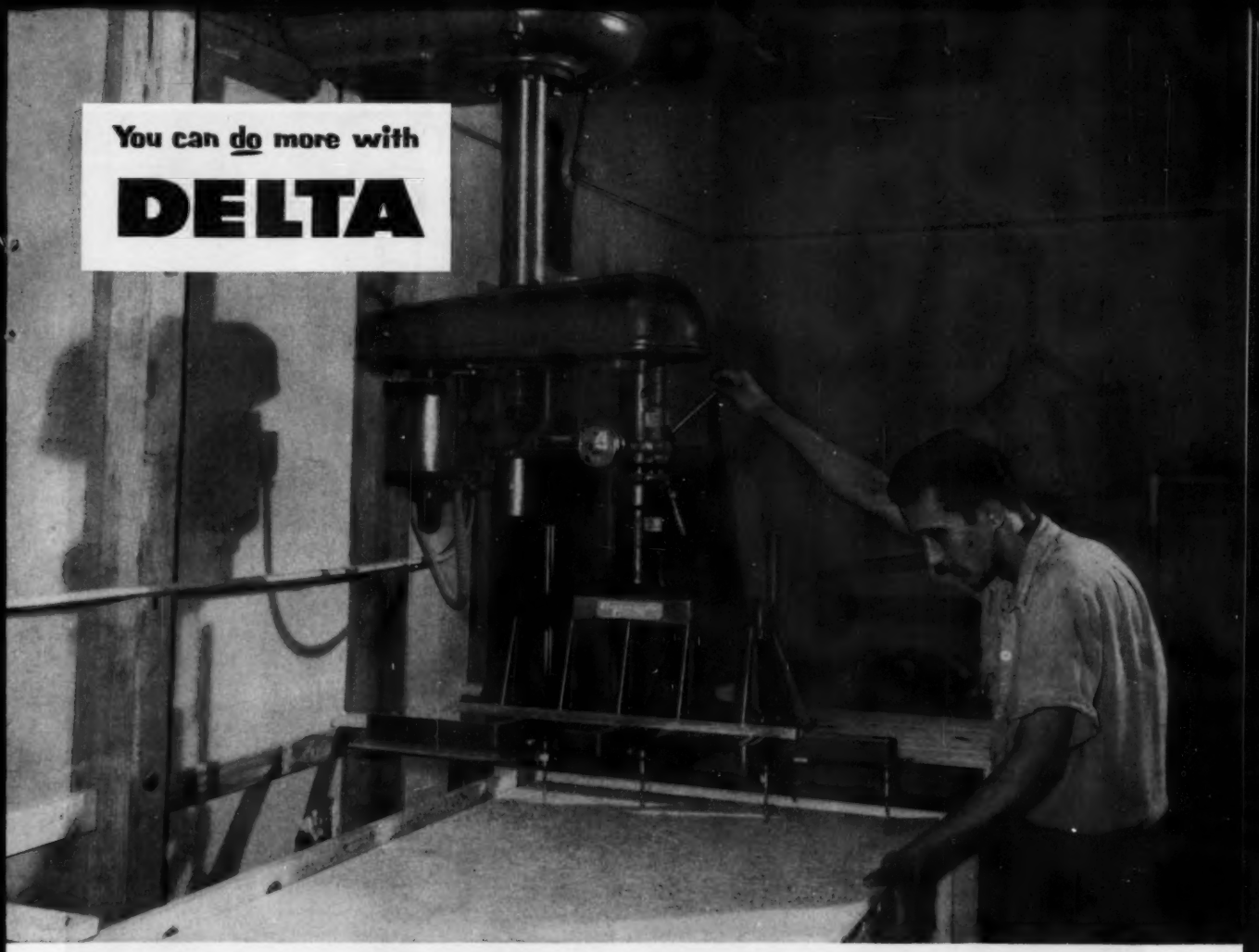
That means fewer parts to get out of adjustment. And the one-piece frame and hub simplifies wear adjustment. Gives you greater accuracy, longer!

From the tips of the long-wearing tungsten-carbide faces of the spindle and anvil, to the ratchet stop top, this Lufkin micrometer is superior in every way. **The exclusive cam lock locks setting** at a flick of the thumb . . . prevents costly reading errors.

Notice how those big numbers and wide-spaced graduations stand out against the soft, nonglare Chrome Clad® finish? Makes reading fast and accurate. And you can take measurements in places inaccessible to many other micrometers!

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. See him for prompt and reliable service. LUFKIN, Saginaw, Mich.





Costs cut 50% in multiple hole drilling

Delta 17" Drill Press, also 20", 15", 14" and 14" Super-Hi Sensitive. Available in floor, bench and multiple-spindle models.

Suspending a standard 17" Delta drill press from an angle iron wall bracket over a table not only *doubled* productivity, but resulted in greater accuracy in wide panel drilling work for S & S Visual Company, a Brooklyn display firm. Use of a Commander multiple spindle drill head permits simultaneous drilling of up to 15 holes in a line 35" long. Avoiding costly single-purpose equipment, the firm used versatile, standard Delta components for this relatively inexpensive installation.

Every model in the world's most complete drill press line offers the power, precision performance and ruggedness that have set industry standards for years. Delta drill presses give you better value for your money—they cost less to buy, less to operate and less to maintain.

To match the tools to *your* needs, visit your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages). And for a FREE Delta Industrial Catalog showing 61 machines, 302 models, over 1400 accessories, write: Rockwell Manufacturing Company, Delta Power Tool Division, 618-DC N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

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20 ft. Niles boring and turning mill recently installed at A. O. Smith Corp., Milwaukee, turning a large cylinder part.

The Octagon Boring Bar . . . The NILES Name

Niles machine tools have turned tons of chips over more than a half-century of production in most of America's largest metalworking plants.

Boring mills bearing the Niles name have another easily recognizable feature—the octagon-shaped boring bar.

Beneath (and behind) these external distinctions is *proved quality*, the *real* measure of profitable machine tools.

For boring and turning mills, 10 to 45 ft. table size, engine lathes from 50 in. swing and larger, and planer-type milling machines, check Niles first. They're built to do big jobs . . . big chip production . . . with modern electronic controls for high precision.

You don't baby a Niles—it's no baby

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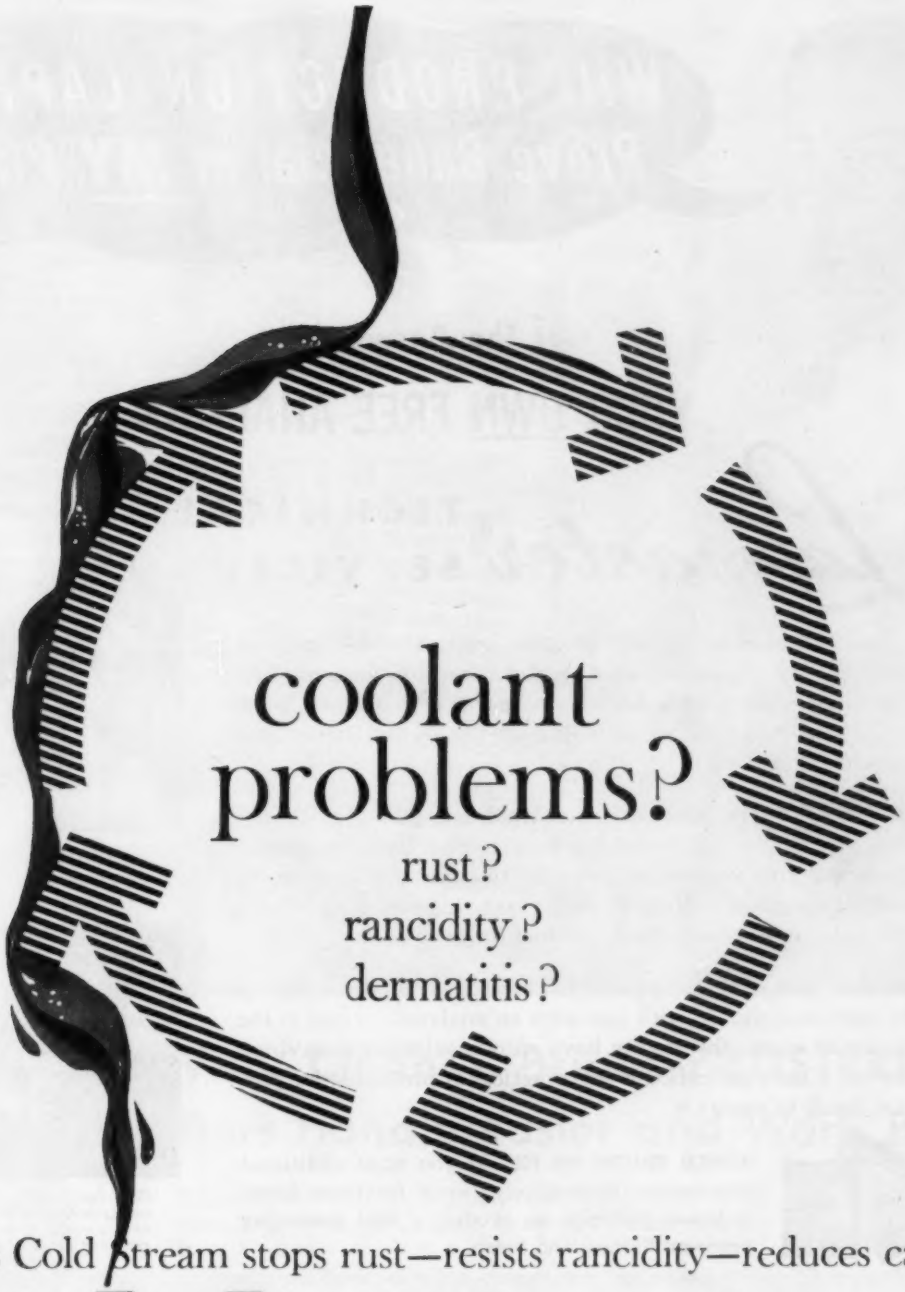

coolant problems?

rust?
rancidity?
dermatitis?

Johnson's Cold Stream stops rust—resists rancidity—reduces causes of dermatitis. These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you all the performance you pay for. **JOHNSON'S WAX**

cold stream

For information, see your local Johnson industrial distributor.

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Will PRODUCTION LAPPING Prove Beneficial in MY Plant?

Get The Answer With

YOUR OWN FREE ANALYSIS

FROM THE *Lapmaster*® TECHNICAL SERVICE

It's easy to prove to yourself whether production lapping will benefit your own manufacturing process...improve your product performance. Just send a few sample parts with surface finish specifications and production requirements to the Lapmaster Technical Service.

We'll test run them in our experimental lapping laboratory and furnish you with a full production report. This complete special analysis will give everything you need to determine how profitable the Lapmaster will be in your plant. Lapped samples will enable you to positively check product improvement.

More than 80% of the successful Lapmaster installations now in daily operation started with just such an analysis . . . and in the majority of cases, the results have shown substantial savings. However, if the application is not practical or profitable for you, we are frank to report it.

TECHNICAL BULLETINS FOR YOU—If you want additional information immediately, write for these latest technical bulletins on producing and measuring precision flatness and finish.

View of our experimental lapping laboratory showing some of the equipment available to test run your sample parts.

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WHAT YOU CAN EXPECT FROM A LAPMASTER

- Surface finishes of 2 to 3 RMS and surface flatness within tolerances of .0000116" with absolute uniformity piece after piece.
- No production bottlenecks frequently caused by other lapping methods.
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- Product performance and quality improved . . . rejects cut to a minimum . . . inspection costs reduced.

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AT NO EXTRA
COST

Why Cleaner, Brighter LUSTERIZED® Bars Handle Easier and Work Better

If you haven't made a comparison run against ordinary cold finished steel bars with clear, bright Bliss & Laughlin Lusterized Finish bars, you will be impressed with the difference.

Lusterized bars start out cleaner, are less messy to handle, remain clean and bright during storage and production. The absence of processing grit, oil and lime keeps chucking mechanisms on automatics free from clogging and production flowing steadily at a profitable pace. The bright, clean surface often requires no finishing operation, reduces the need for elaborate pre-plating preparation.

Lusterized Finish is a Bliss & Laughlin exclusive. It is another result of a constant research program over nearly 70 years to produce cold finished steel bars that will improve your production and profits. Ask for a new folder detailing the production advantages of specifying Bliss & Laughlin Lusterized bars.

LUSTERIZED FINISH is the STANDARD FINISH at Bliss & Laughlin

Specialists in Finish, Accuracy, Straightness, Strength and Machinability

BLISS & LAUGHLIN

Largest Independent Producer of Cold Finished Steel Bars

GENERAL OFFICES: Harvey, Ill. • PLANTS: Harvey, Detroit, Buffalo, Mansfield, Mass.

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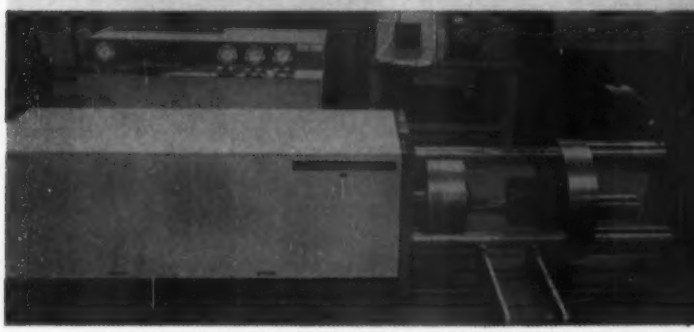
EVIDENCE

▶▶ *Here is clear evidence that high velocity extrusion of metal has dispersed stringy non-metallic inclusions. The part pictured is a hinge pin for* USAF's *B-58 Hustler. The pin on the left was machined from* AISI *4335 modified bar stock. The clearly visible inclusions made the part unfit for service. The pin at the right is made from the same material, but only after it had been extruded at very high velocities by a* DYNAPAK *machine. The inclusions have been eliminated. The part is completely satisfactory. There is no need to change to a more costly metal, or to resort to special mill heats.*



Pneumatically energized DYNAPAK, a product of General Dynamics Corporation, is industry's first practical tool for high-energy-rate metalworking. Many industries are now adapting DYNAPAK to the solution of forging, forming, and extrusion problems. The experience of Convair Fort Worth with these hinge pins gives evidence of another of DYNAPAK's advantages. The hydrodynamic [illegible] of metal when it is worked at DYNAPAK velocities results in homogeneity and refinement of structure, and in dispersal of inclusions.

for complete information, write, wire, or phone:

DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Phone: NAtional 3-1561

This is another in a series featuring the views of owners of leading contract tool and die companies

"NO TASK seems too difficult for this remarkable new Moore No. 3 Jig Borer"

...writes A. A. Zeise
of Tool Products Company, Minneapolis, Minnesota

"Our ability to offer the finest work on the best equipment has consistently rewarded us with gratifying success and steady growth during the past 13 years. With Moore equipment we have always been able to assure highest accuracy and top quality in our day-to-day toolroom work.

"And now, with the recent addition of our Moore No. 3 Jig Borer, we are hitting a new high in precision—constantly achieving tolerances of .000050 (50 millionths). Located in our temperature controlled room, no task seems too difficult for this remarkable Moore machine."

You, too, will easily break the "tenth" barrier—boring, drilling, reaming and spotting holes in dies, jigs, and production parts—with the new Moore No. 3 Jig Borer.

It offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...and a speed range of 60 to 2250 RPM.

Write for illustrated brochure. Ask also for information on the new No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

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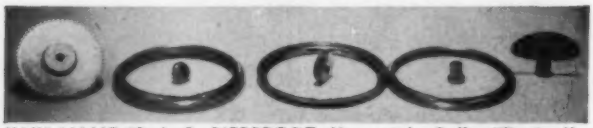
REPORT FROM WESTCLOX • *Division of General Time Corporation*

"Here's how we save $46,464 annually by deburring clock parts with ALMCO BARREL FINISHING EQUIPMENT."



"MY NAME IS A. R. BIERBRODT. Here at La Salle, Illinois, I'm Supt. of Metal Finishing for the Westclox Division of General Time Corporation, makers of the famous Big Ben alarm clocks. I'd like to show you how we save big money by using ALMCO barrel finishing machines for deburring and finishing 24 different clock parts in our plant."

(1) "Here, John Chambers lifts the hood of one of our 10 ALMCO machines. We figure we save $46,464 annually by deburring and finishing clock parts with ALMCO barrel finishing equipment."

(2) "Parts to be finished are added to predetermined proportions of media and compounds. A total of 10,000 cast gear wheels, for example, can be deburred and finished in one hour's time."

(3) "Lock 'er up and we're ready to go. Previously, when these clock parts were deburred and finished with power tools, only 3,500 parts were finished during an 8-hour work period."

(4) "A flip of the switch and the precision process begins. Burrs are removed, rough edges smoothed to specifications, and 80,000 perfectly finished parts delivered to production lines each day."

(5) "Here, Harry House, Foreman, inspects clock parts finished by ALMCO Supersheen equipment and methods. Barrel finishing has given us a daily labor saving of $193. What's more, quality and uniformity are good and production is way up. Results are truly outstanding."

LEARN HOW MODERN BARREL FINISHING can improve your product! The facilities of ALMCO's new technician-staffed lab in Albert Lea, Minnesota, are available to you without obligation. Send your sample parts with specifications desired or write on your company letterhead requesting an ALMCO engineer to visit your plant.

SEND FOR YOUR FREE barrel finishing handbook. 52 pages of case history facts and barrel finishing processes. Illustrated equipment section. Includes detailed cost chart on finishing of typical parts. Send for your free copy today!

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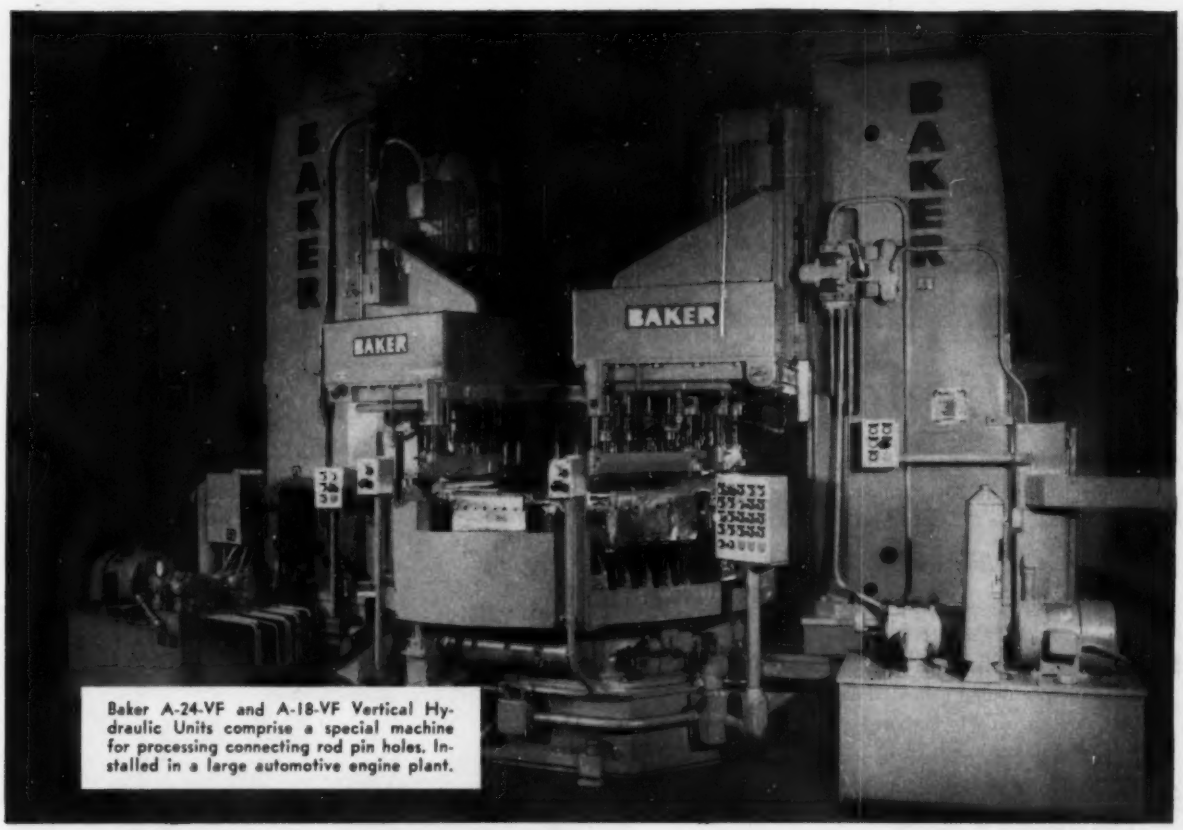

Baker A-24-VF and A-18-VF Vertical Hydraulic Units comprise a special machine for processing connecting rod pin holes. Installed in a large automotive engine plant.

SPECIAL MACHINE BUILT WITH THE STANDARD BAKER® COMPONENTS

The job: Drill to one-half depth, drill through, ream and chamfer automotive connecting rod pin holes.

BAKER engineers came up with this cost-saving answer: 2 BAKER Standard Vertical Machines in combination with a new 7-position, 72" index table.

The table is driven from an outside source and is designed so that all components are removable from the outside without disturbing fixtures or table top.

Except for the fixture, all components are standard. The drilling heads are standard BAKER fixed center units, with special bushing plates. Production rate is 600 parts per hour gross.

If your plans call for special machines to be built within an economy budget, investigate the design versatility of BAKER Standard Hydraulic Drilling and Tapping Machines. Write to: BAKER BROTHERS, INC., DEPT. AS-360, 1000 POST STREET, TOLEDO 10, OHIO.

BAKER®

MMT=PE

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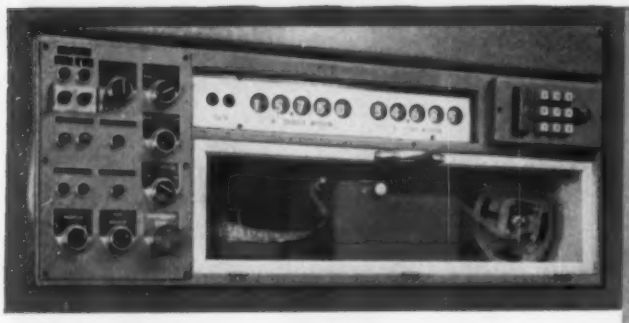

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Sensational New Numerical Control

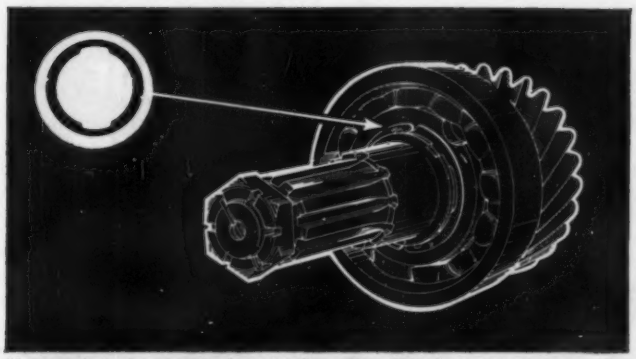
A new numerical control just perfected by Carlton Controls Corporation, applied to The Carlton Machine Tool Co. horizontal and planer type boring and drilling machines . . . offers:

1. *Tape control* for automatic 3-axis positioning of tool, plus automatic speed-feed changes. Tape is standard 1" wide 8 channel.
2. *Keyboard* for separate non-taped operations provides manual input of 5- or 6-digit numerical data for each axis. Numerical values, actuated by keyboard or tape, are presented visually by indicator lights.
3. *Zero offset* establishes new starting point from the workpiece regardless of location.
4. *Pushbuttons* control rapid traverse and slow traverse power driven units, position the axis movements for manually operating the machine to establish different data points.

For complete information on how any shop can automate boring, drilling, reaming, tapping . . . and make fuller use of drilling machine tools . . . write us today. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

specialists in boring and drilling machines since 1916



Heavy duty transmission design simplified. On this dual axle drive for trucks, a Truarc Series 5107 ring locks bearing on drive shaft. Interlocking ring design won't dislodge under heavy torque . . . is also recommended for high rpm. applications.

Designing with radially assembled Waldes Truarc retaining rings

solve varied product design problems—save machining, materials, parts and labor

Radially assembled retaining rings, which snap onto a shaft at right angles to its axis, greatly extend the range of products on which retaining rings may be used to simplify design and save parts or labor costs.

For example, rings for radial assembly can be used in applications where it is impossible to install a ring axially over the end of a shaft. Certain types are designed to accommodate shafts of relatively wide tolerances. Others described below may be used to provide a sizeable shoulder on a shaft.

The four applications shown here provide an indication of the wide range of products using radially assembled rings. The rings themselves are basic Truarc types each having specific design features. The high shoulder of one provides a large bearing surface on small diameter shafts; the low shoulder of another is ideal where clearance is limited. A third has an interlocking design which prevents it from being dislodged under torque or high rpm. A fourth can be used against rotating parts at the same time it provides spring tension.

These are but four of Truarc's fifty functionally different types of retaining rings with up to 97 sizes within a single type, six metal specifications and thirteen different finishes. Special hand, magazine, and semi-automatic applicators as well as grooving tools are also available to speed production. The entire line, together with over 70 typical applications, is described and illustrated in the new catalog RR10-58—yours for the asking. And call on us for design assistance on your specific project . . . a Waldes Truarc engineer will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

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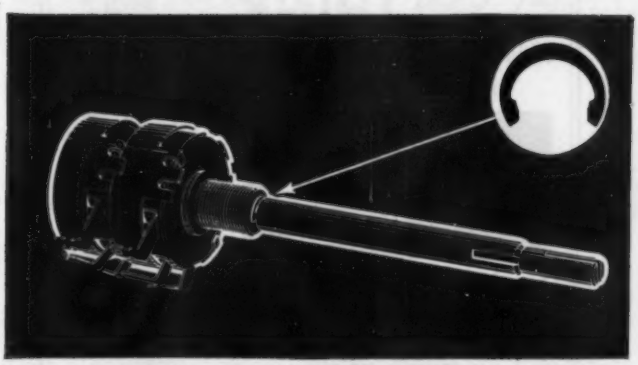
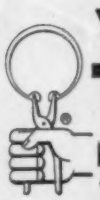
Rings replace machined shoulders, collars, set screws. That's what original design of this pneumatic temperature transmitter called for. Series 5139 Prong-Lock® ring with bowed design compensates for accumulated tolerances in parts, provides sufficient friction to prevent rotation under vibration. At the same time two Waldes E-rings position and lock adjustment screw to face plate.

Reinforced aluminum ring gives design advantages on louver windows. Waldes Truarc Series 5144 reinforced rings of aluminum secure hinge pins, eliminate costly riveting in linkage of louver type window. Ring design provides large bearing shoulder. Reinforced construction has 5 times the gripping strength of standard E-ring construction, allows use of non-corrosive aluminum.



Ring acts as locking shoulder. Holding the threaded ferrule on this potentiometer shaft is a Truarc Series 5103 Crescent® ring. Crescent ring design with low shoulder provides ample clearance for assembly of panel locknut. It is less costly than a machined shoulder, more effective, quicker to install, easier to remove than the C washer previously used.



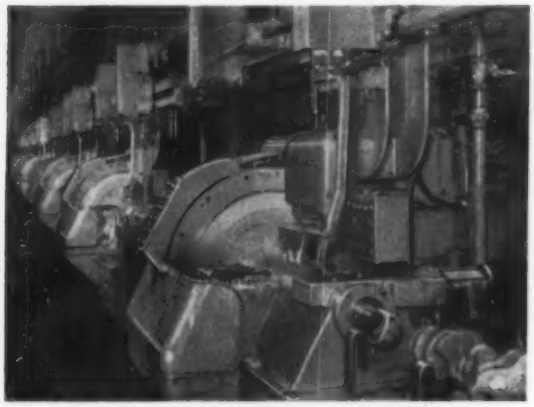
WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS...THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

WICKESmanship

"TURNS UP" more profits for your crankshaft production



Here's crankshaft production efficiency that results in lower initial and unit costs for every job . . . guaranteed by an outstanding record of customer satisfaction over the years. Dispensing customer satisfaction is standard procedure at WICKES Machine Tool—and it shows up in the only complete line of CRANKSHAFT LATHES built in the world today. Call your WICKESman—let him show you how WICKESmanship can help you produce more efficiently.

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CENTER DRIVE LATHES AND BORING MACHINES • SPECIAL MACHINES

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Spur Gears and Pinions

Rigid inspection from first to last insures exact compliance with customer specifications. These 61.274" O.D., 5" F., 56.187" I.D., 108 T., 1¾" C.P. semi-steel ring spur gears and steel spur pinions—8.355" O.D., 5½" F., 13 T., 1¾" C.P., are being given final checks before shipment. Accuracy and prompt delivery are bywords at Stahl Gear. Our estimate will convince you.

SPURS TO 72" PD. 1 DP
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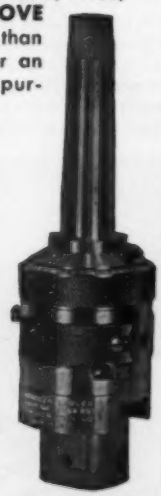
NOW you can have a boring head that will **BORE, FACE, TURN** and **GROOVE** at no higher cost than you would pay for an ordinary, single purpose boring head

THINK

This over before buying that NEW head!!

A Boring Head That Won't Face is NOT Complete



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Models for Any Size Machine

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COMBINED BORING AND FACING TOOLHEADS

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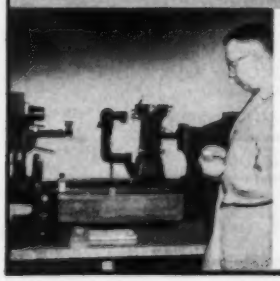
HOW ADAMAS HELPS *Mack* BUILD TRUCK PARTS THAT LAST FOREVER

Cross section

Unique, patented carbide-faced valve lifter boasts "never wear out" performance!

AT MACK—ultrasonic inspection equipment of the resonant-frequency type is used to insure the absence of flaws after the tungsten carbide discs are bonded to Mack's Duraface valve lifters. Following a special electrolytic treatment which trues up the tungsten carbide working surface, a probe is placed over the disc and the condition of the unit registers on the cathode ray tube.



AT ADAMAS—using the latest metallographic equipment; Jack Powers, Supervisor of Metallography, submits the tungsten carbide discs to a microscopic examination, the final step prior to shipment. Rigid laboratory tests include: chemical analysis of powders, grain size checks, Rockwell hardness, density (weighed to .0001 grams) and transverse rupture strength of sintered pieces.

• Mack's exclusive Durafaced® valve lifters are faced with specially formulated Adamas tungsten carbide discs, .060 in. to .070 in. thickness, furnished ready for application.

A secret patented process is used to bond the tungsten carbide discs to the valve lifters. The discs, unmatched for uniformity of quality, contribute to the peak operating efficiency of the Mack Thermodyne® diesel and gasoline engines!

The flatness of the valve lifter face is held to 0.0005 in., permitting only a slightly crowned surface with a finish of 5 rms. The Adamas tungsten carbide discs, manufactured under precise quality control procedures, have a hardness of 89±.5 Rockwell A.

Mack reports that valve lifters protected by Adamas tungsten carbide discs have shown no evidence of wear after hundreds of thousands of miles of service.

If you are looking for durable, dependable and economical carbide products to meet your specific conditions—specify "Adamas"! For product information or sales engineering assistance, write to:

Producers of Tungsten Carbide Tools, Tool Tips, Dies, Wear Parts, Gas-A-Tool

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PROGRESSIVE CARBIDE USERS
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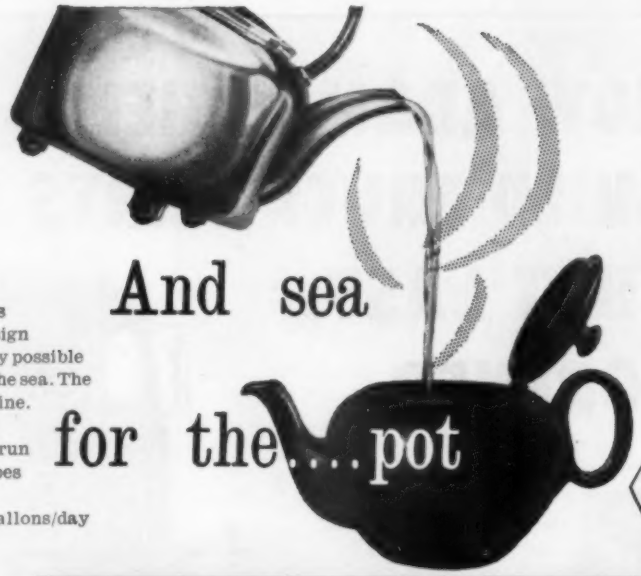
See ADAMAS at BOOTH 920, ASTE TOOL SHOW



And sea for the....pot

In arid parts of the World this is by no means as absurd as it sounds; recent advances in the design of flash evaporators have made it economically possible to supply entire towns with fresh water from the sea. The cost may often be less than that of a long pipeline. This type of elevator, which was pioneered in Great Britain by Richardsons Westgarth, will run continuously with little or no attention and does not have to be shut down for clearing of any deposit that may form. Units of up to 300,000 gallons/day are at present in operation or in production. Since these units make use of steam at sub-atmospheric pressure they are particularly economical in connection with industries using low pressure steam or back-pressure turbines. As we are also builders of steam and gas turbo-alternators, water-tube and Economic boilers, we are particularly well able to design and carry through complete schemes, with any fuel, for the production of power and fresh water.

R W G

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Taps nuts and screw machine parts automatically to close tolerances. Produces smooth, clean threads square to nut bearing surface. Maintains high production with minimum tapwear. Safety devices prevent tap breakage. Complete information available on request.

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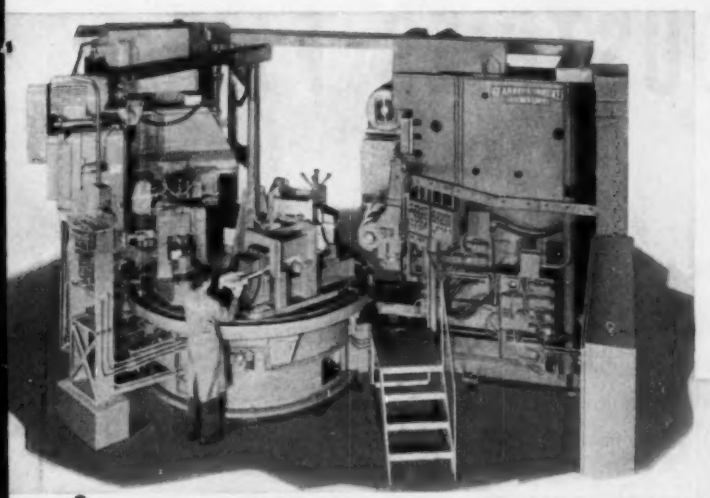
MMT=PE

Kearney & Trecker builds production machine tools for every industry *



For Over 60 Years, Kearney & Trecker engineers have helped solve production problems of metalworking industries. Whatever your product or problem, Kearney & Trecker Custom Engineering Service can help you find cost-reducing solutions. Backing up this outstanding service is one of the most up-to-date plants in the world devoted exclusively to manufacturing modern production machine tools.

For the Whole Story

. . . ask your local Kearney & Trecker representative for Bulletin SMD-57 . . . 16 pages packed with *"Performance-Proved"* examples of how K & T Custom Engineering has paid off for manufacturers in every industry.

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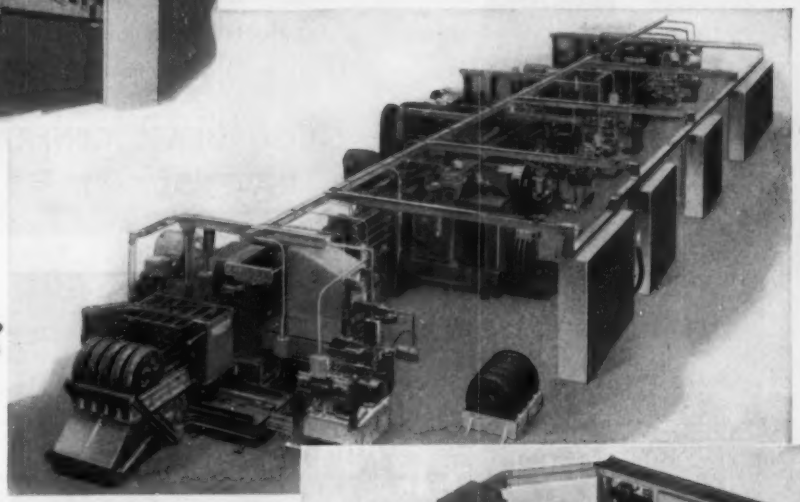
3 station rotary index machine mills root ends on large turbine buckets.



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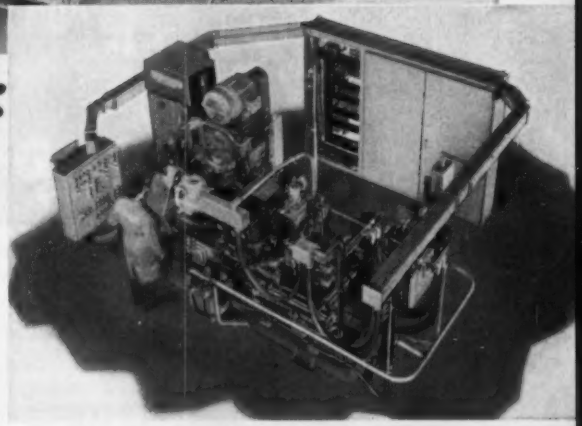
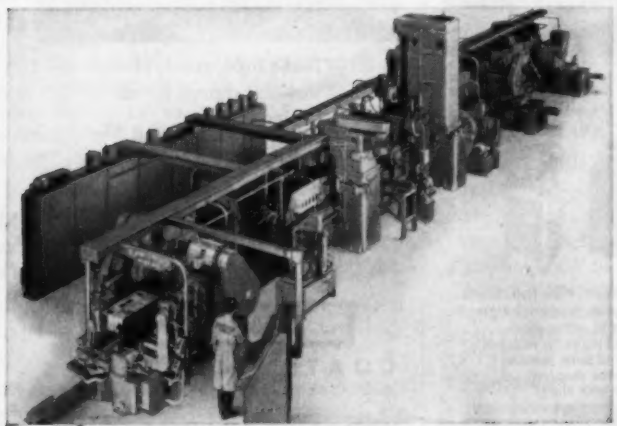
30 station railroad car wheel boring, facing, and turning machine.

AIR CONDITIONING INDUSTRY *
Mills cylinder pads and feet on a variety of compressor housings.





* **DIESEL ENGINE INDUSTRY**
15 stations — 31 milling, drilling, reaming operations on 6, 8, 12-cylinder, V-type engine blocks.

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You can't afford it!

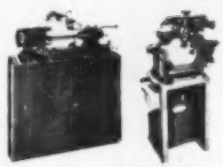
As the pictures show, taps cost roughly 6 times as much as drills. Yet it's common practice to re-sharpen the drill — and throw away the tap.

It doesn't make sense. And it's an awful waste of money.

That's where Blake comes in.

Blake makes low cost, high-precision tap grinding equipment. These easy operating tools can make your taps last up to 6 times longer . . . reduce work spoilage . . . enable taps to cut more accurately and uniformly with less strain . . . cut tap costs as much as 65%.

It's surprising how many people overlook this proven, basic method of saving money. Be sure you don't. Ask us for complete information.



Blake Chamfer Grinder/Blake Flute Grinder used in combination, create or restore:
1. exact indexing of cutting edges.
2. controlled rake angles for each job.
3. correctly ground spiral points.
4. perfectly relieved chamfers . . . make one tap do work of six!

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"That's right, son . . . I wouldn't change for all the tea in China!"

Loyalty is a common trait among Jewel Brand Abrasive Belt users. Once you've tried them, it's easy to see why. Job after job, year after year, they never let you down. Try 'em and see!

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ABRASIVE PRODUCTS, INC.
South Braintree 85, Massachusetts

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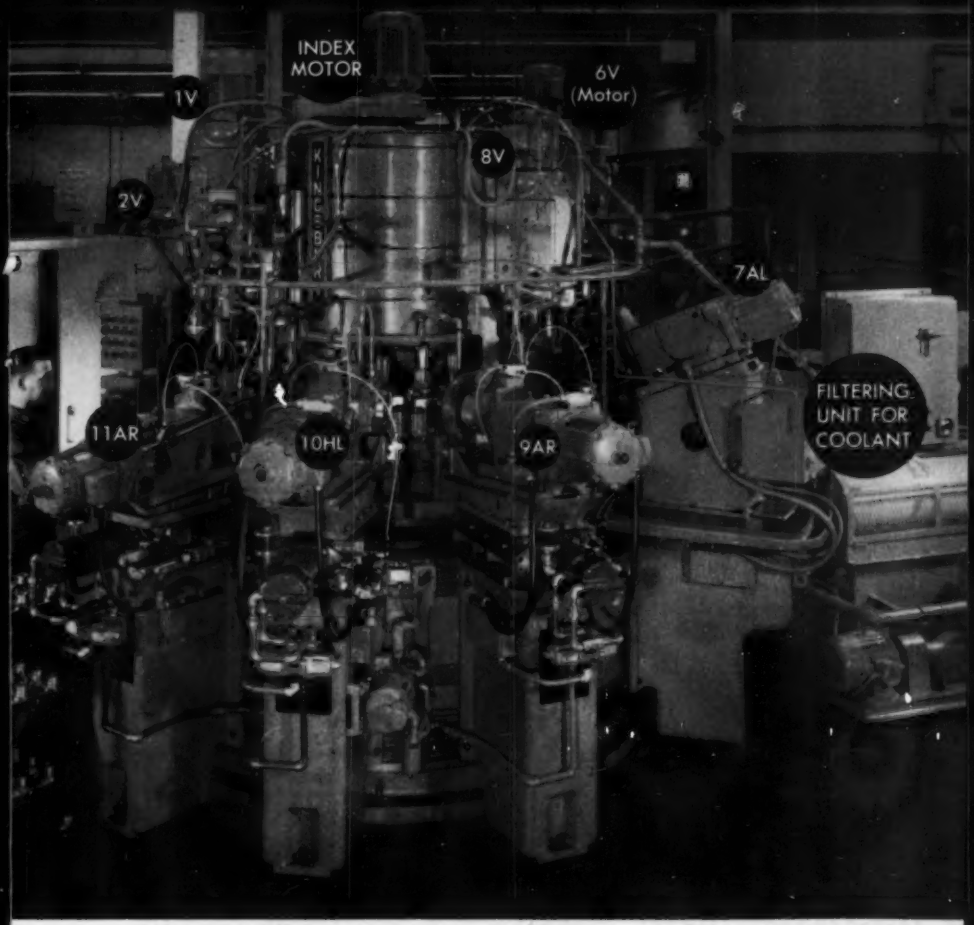

Kingsbury machine produces fine finish at high rate, performs variety of operations

Easy change-over for work on similar part

In one chucking of the work twelve units on this Kingsbury perform all of the operations shown. With a 19-second time cycle for the operations and indexing, the gross production rate is 190 parts per hour.

SOME NOTEWORTHY FEATURES

Mill face. A motorized spindle produces a fine finish by running at high speed and then retracting from the work on the return stroke.

Mill oil pockets. Airdraulic slides position oscillating heads that feed the cutters sideways inside the hole.

Drill angular oil holes. Each unit is at an angle to the radial center line through its station. Two units are mounted on angular risers.

Five-step valve hole. Two units step gun ream with high speeds and fine feeds using filtered coolant under pressure.

With a few changes this machine also operates on a similar part. A seven spindle auxiliary head can be mounted in two different positions to drill four holes in one part or three in the other.

WE BUILD SIMPLE MACHINES TOO

If you do drilling type operations in high production — simple or complex — we want to talk business. Our good basic design and accurate rugged construction pay off for you in minimum rejects and downtime. Kingsbury Machine Tool Corp., Keene, New Hampshire.

MMT-PE

KINGSBURY MULTI-UNIT AUTOMATICS

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12 OPERATIONS ON GOVERNOR BODY

1V Vertical
Step drill valve hole through

2V Vertical
Mill face 7200 rpm fine finish

3H Horizontal hidden
Rough bore large hole

4AL Angular left, hidden
Drill angular oil hole

5H Horizontal, hidden
Drill flash in 4 holes

6V Vertical
Step gun ream part of valve hole

7 HR Horizontal right, hidden
Drill angular oil hole

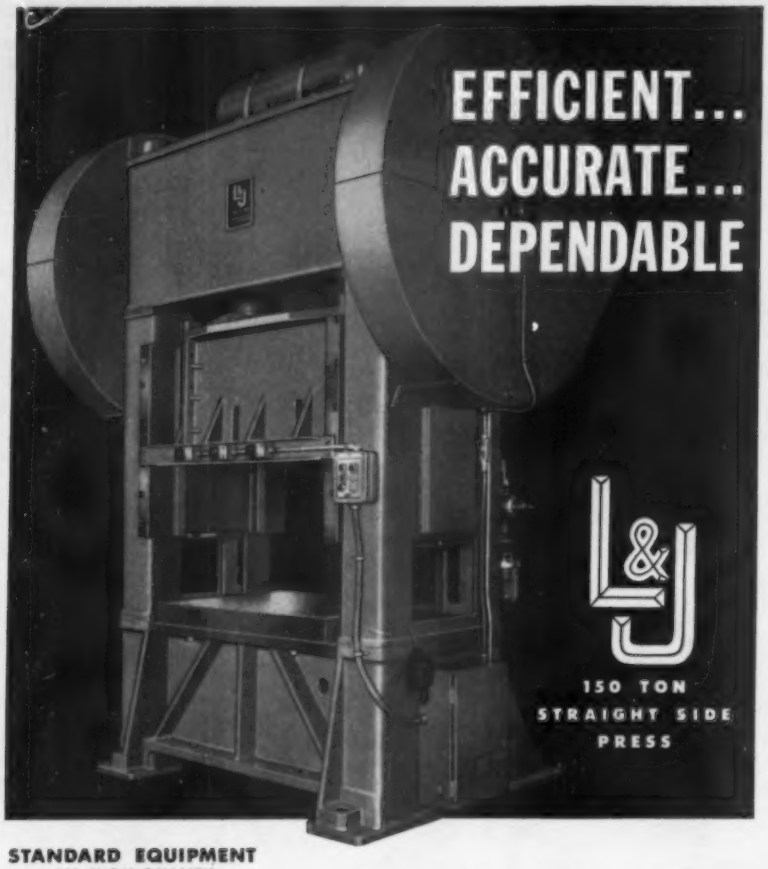
7 AL Angular left
Drill angular oil hole

8V Vertical
Step gun ream part of valve hole

9AR Angular right
Mill first oil pocket

10HL Horizontal left
Mill second oil pocket

11AR Angular right
Mill third oil pocket



STANDARD EQUIPMENT
ALL HIGH QUALITY

Including—Air clutch. J.I.C. wiring and controls. Shaft driven limit switch. Solenoid-controlled dual air valve. Replaceable wear strips on slide. Hard bronze crankshaft bearings. Replaceable ball seats. Air counter balances on slide. One-shot forced lubrication. Gears run in oil. *Optional equipment as required.*

- **Single geared, twin end drive, double crank.**
- **Maximum quality throughout.**
- **Long, square gibbing maintains perfect slide alignment.**
- **Heavy welded steel box-type frame with tensioned tie rods insures rigidity.**
- **Proven L & J quality gives long, dependable service and cuts maintenance costs.**
- **Large die space — 48" x 36" slide face, 48" x 36" bolster area.**

WRITE for complete information on 20- to 150-ton straight side presses, 14- to 150-ton O.B.I. presses and 30- to 75-ton gap frame presses.

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ELKHART, IND.

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American Machinist/Metalworking Manufacturing Special Report Number 410 outlines the plastics most widely used; the new materials now available; and the new toolmaking techniques that are being developed. Case histories illustrate current applications of these methods in Metalworking. Send 25¢ and your name and address to:

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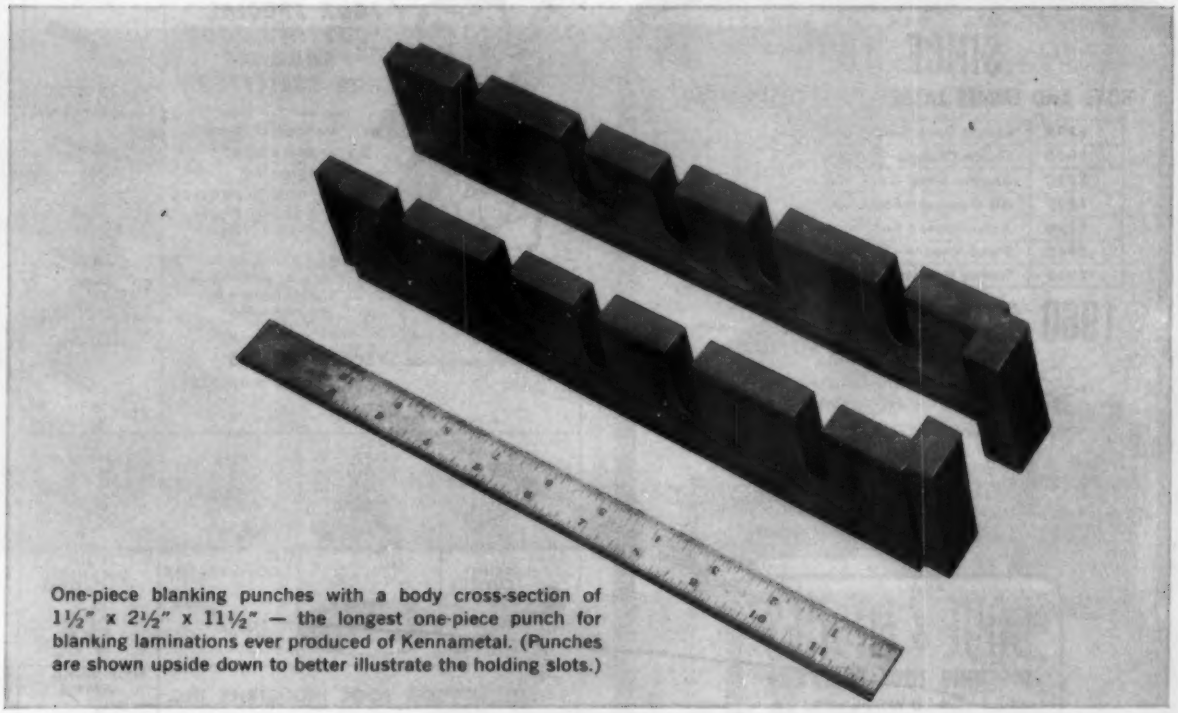

One-piece blanking punches with a body cross-section of 1½" x 2½" x 11½" — the longest one-piece punch for blanking laminations ever produced of Kennametal. (Punches are shown upside down to better illustrate the holding slots.)

Longest KENNAMETAL* one-piece blanking punch makes 700,000 hits between grinds

When Star Metal Products Company, Chicago, was commissioned to develop blanking punches and a die section of carbide to produce silicon steel laminations 12⅜" long, it was immediately apparent that the carbide punches should be of one-piece construction. This presented a problem, as punches of this size would ordinarily be made in two or three sections.

After consulting with a number of carbide manufacturers, Kennametal Inc. was selected to make the molded carbide sections. Everede Tool Company, Chicago, was chosen to construct the die. Within seven weeks the die was in operation . . . setting top-rate performance records in producing large laminations for ballast-type transformers used to light new 200 watt neon lamps.

Material laminated	Silicon Steel
Die life in inches	.750
Die life in grinds	75
Amount removed per grind in inches	.010
Number of hits between grinds	700,000
Total estimated hits for full life of die inserts	52,500,000

This performance is due largely to the *one-piece* construction of the Kennametal blanking punches, as they maintain proper size of laminations during life of punch; provide longer punch life; permit longer runs between regrindings; reduce downtime normally required to clean and realign punch sections; eliminate possibility of producing jagged laminations—which might occur through any separation of section joints of multiple-section punches.

The exceptional characteristics of Kennametal hard carbide alloys, plus our engineering service, have provided the solutions to many problems . . . in many fields. They could prove equally helpful to you on some project. For further information contact your Kennametal Representative or write KENNAMETAL INC., Latrobe, Pa.

*Trademark

In addition to blanking punches, Kennametal parts include 3 slotting and 11 piercing punches, 2 scrap cutting inserts, and all die cutting sections.

97282

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1895	Single Back Gear Cone Lathes
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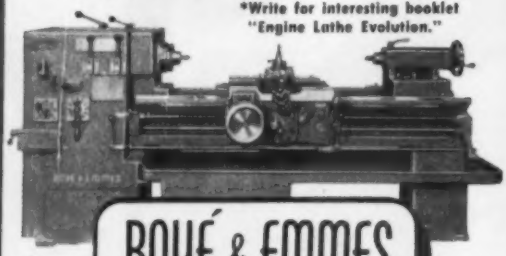
1940	Steel Vees — High Speeds
1950	Tracer Controlled

1960 Ask about it
Write about it
Come see it

*Write for interesting booklet "Engine Lathe Evolution."



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MACHINE TOOL CENTER of the WORLD

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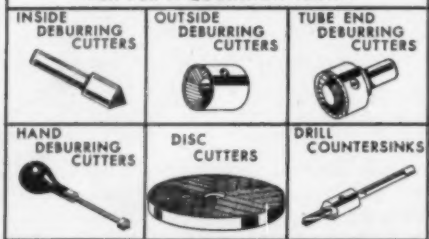

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New report is free to manufacturers

RICHARD L. WHITE, former president of the National Electrical Manufacturers Association, has prepared a 16-page report entitled "*A New Look at Metal Working in Puerto Rico.*" Mr. White's views are based on his experience in hardware and electrical appliance manufacturing over a thirty-five year period.

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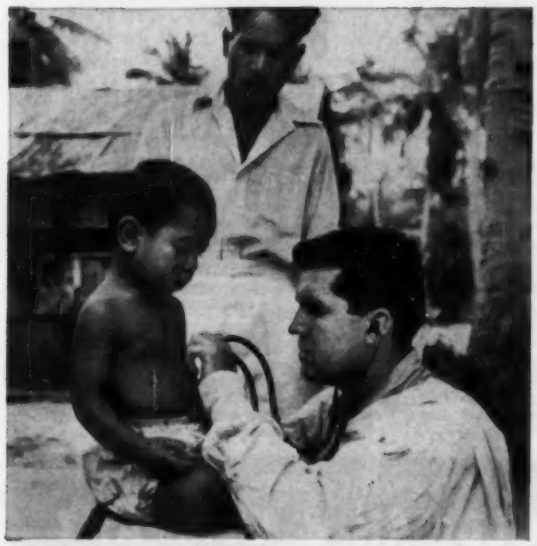
OFFICIAL UNITED STATES NAVY PHOTOGRAPH

This great seaborne health center will carry a new kind of aid abroad—*with your help.* Part of the people-to-people project Hope, it will enlist 200 specialists in sharing our health skills.

Ambassador with a blackboard, the Hope specialist will help the often woefully few local medical technicians train helpers. The result: many more hands. And that means one Hope dollar is multiplied many times over.

YOUR HELP CAN COME BACK A HUNDRED TIMES OVER



One local doctor for 100,000 people. These are the odds Hope may face. Yet Hope can mean so much. The health of this child. The health of five Indonesians. *Trained* hands and only a dollar's worth of penicillin can cure them of crippling yaws.

If enough of us help, the S.S. Hope will be outbound in 1960. First port of call: Indonesia. A bold health project called Hope will be underway.

The need is crucial. Many places, too many health hazards exist. Too many people robbed of the will to live. Too few hands to help. Often, a doctor for 100,000.

Hope's approach is *practical.* Help where a nation's doctors ask help. Help them help themselves to health. By training, upgrade skills—multiply hands. Hope's doctors, dentists, nurses, and technicians will man a center complete to 300-bed mobile unit and portable TV.

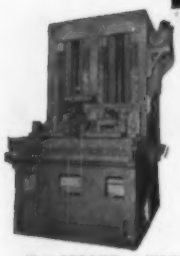
You can not only make every dollar do the work of many, you can earn a priceless dividend. With health comes self-respect. People at peace with themselves are less likely to war with others.

Hope is *yours* to give. It's a people-to-people project. For one year's worth, 3½ million Americans must give a dollar. Don't wait to be asked. Mail a dollar or more now to HOPE, Box 9808, Washington 15, D.C.

HELP LAUNCH HOPE

AMERICA'S FIRST NAME IN USED MACHINERY

HARVEY GOLDMAN AND COMPANY



BROACHES

— AS LATE AS 1953 —

VERTICAL SURFACE

Tons	STROKE	MAKE	MODEL	RAMS	TABLES
10	84"	Cincinnati	10-54	Dual	Swivel
10	54"	Colonial	VA2-10-54-D2	Dual	Shuttle
15	72"	LaPointe	SRV-15-72	Single	Rotary.
15	60"	Colonial	VAI-15-60-SL	Single	
25	96"	American	SBD 96-25	Dual	Shuttle
30	72"	American	SBD 72-30	Dual	Swivel
10	30"	American	T-10-30	Single	Tri-Way

HORIZONTAL

Tons	STROKE	MAKE	MODEL	RAMS
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6	48"	Oilgear	XL-12	Single
50	78"	LaPointe	HP-100	Single

12½ Footburt Continuous Chain Surface Broach, 60" Tunnel

KINGSBURY AUTOMATIC DRILLING & TAPPING MACHINES

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BASES: 60", 72", 80" and 84" dia.

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HEADS, DRILLING & TAPPING #8, #14, #18, #22 and #30.

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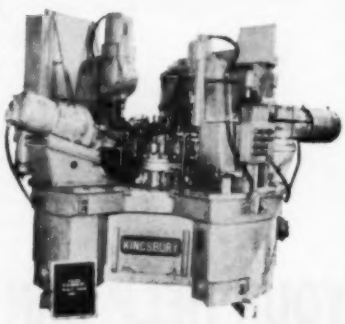
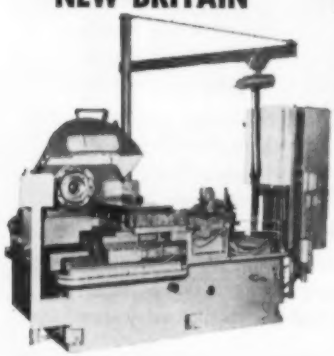


MODEL 330 NEW BRITAIN BORING, TURNING & FACING MACHINE Mfg. 1952



- In New Condition.
- Single End, Single Spindle.
- Machine will bore, turn and face, either straight or on irregular contour.
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- Infinite Spindle speeds with variable DC Drive
- Coolant Tank & Pump.
- 13" Air Cylinder on Spindle.
- Jib Crane with Air Hoist, for work handling.
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PRICE — $5,250.00

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The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

1. Accessories
2. Automatics
6. Boring Mills
7. Broaching Machines
10. Chucking Machines
16. Drilling & Reaming Machines
17. Electric Motors
20. Forging Equipment
22. Furnaces & Ovens
23. Gear Cutting Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
39. Power Equipment
40. Press Brakes
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46. Roll Formers
48. Saws
50. Shapers
51. Shears
56. Threading & Tapping Machines
58. Welding Equipment
64. Surface Plates

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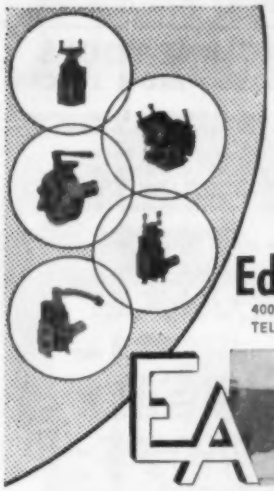

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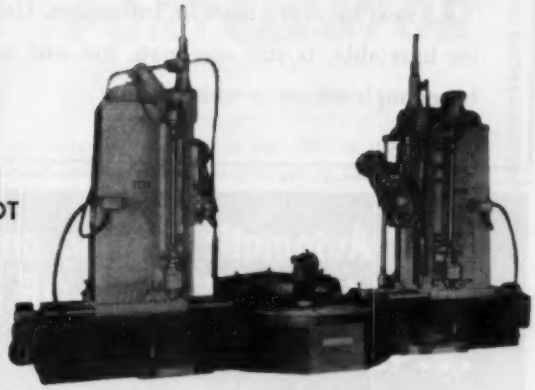

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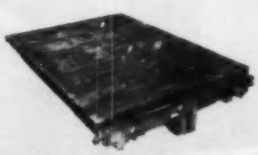

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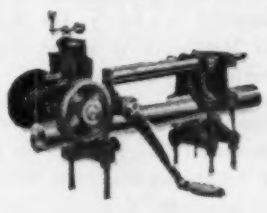

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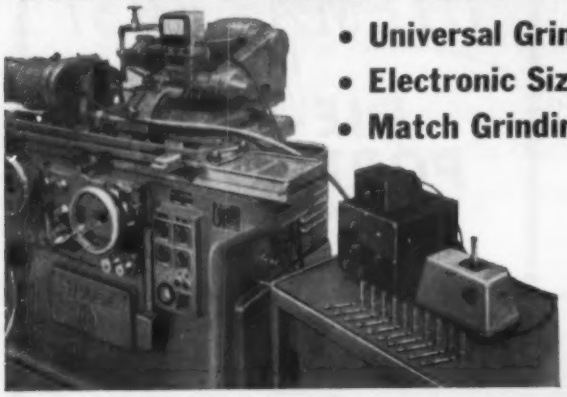

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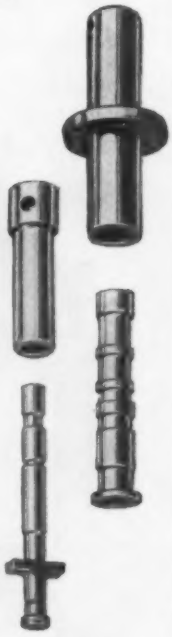

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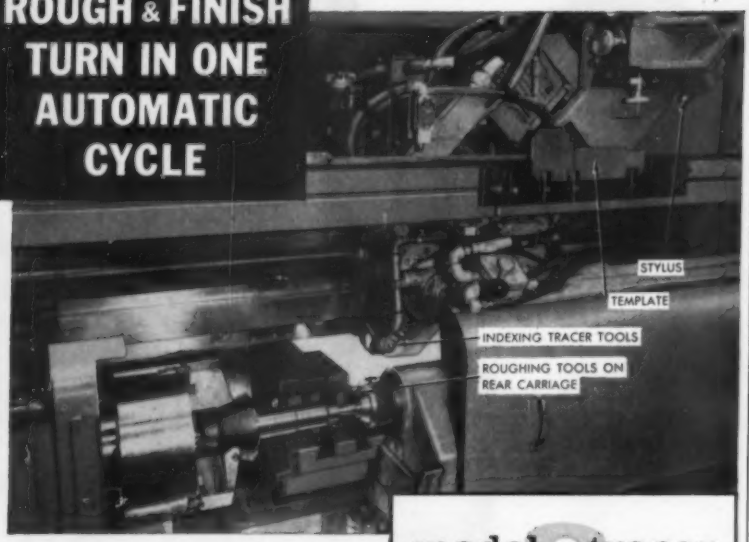

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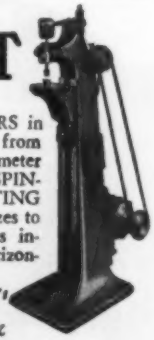

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

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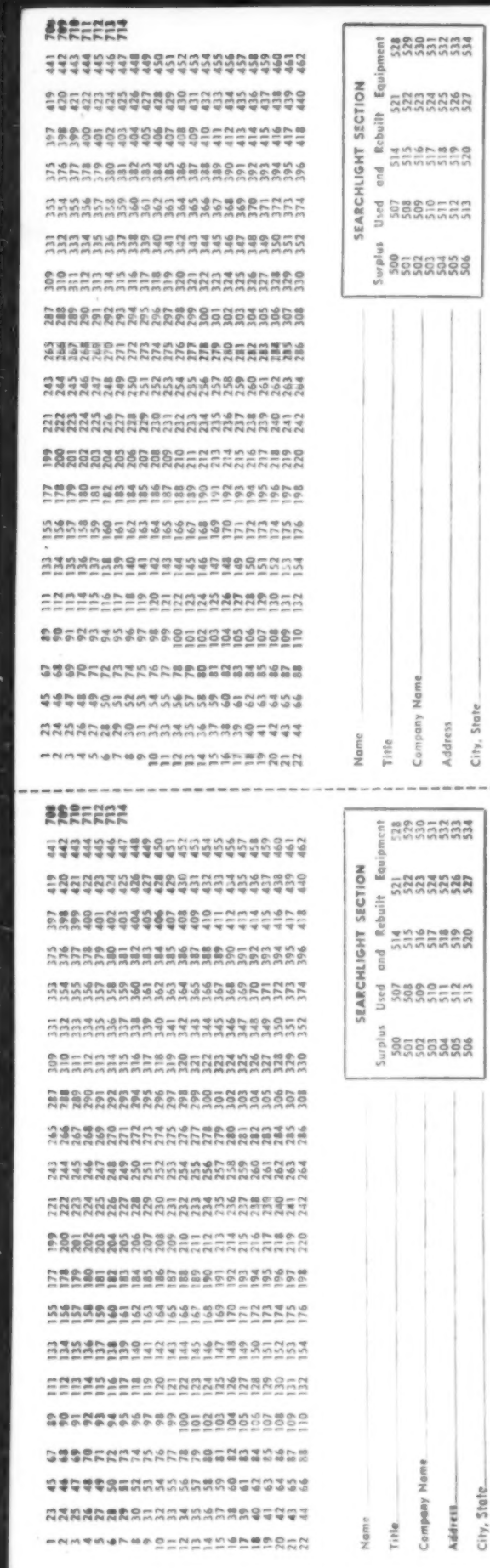

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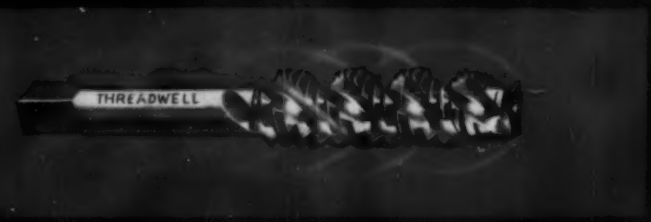

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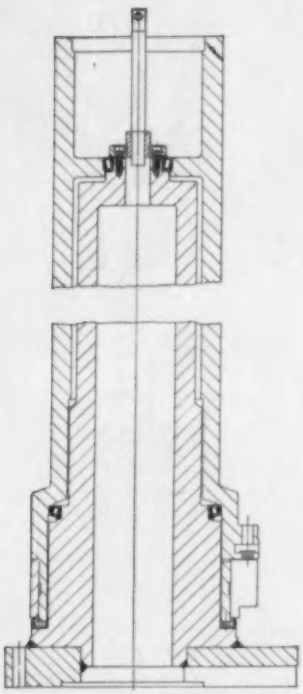

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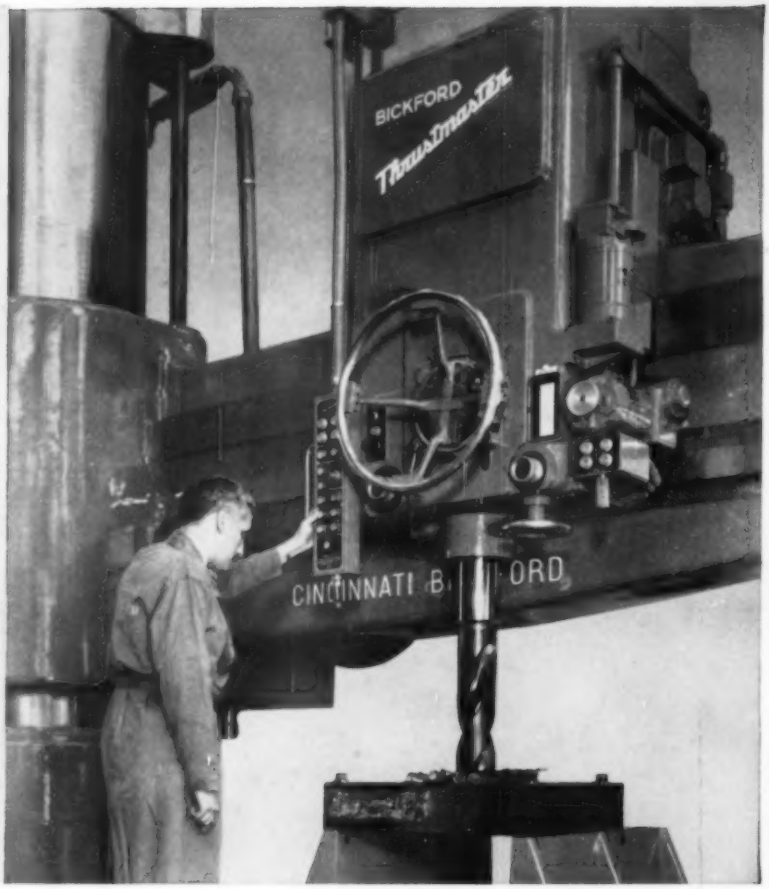

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